The FOUNDRY

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Castings Are Used on Long Natural Gas Pipe Lines

NATURAL gas for many years was regarded as a natural phenomenon and no effort was made to conserve it as a valuable fuel. Later it was used in localities where it abounded plentifully both as fuel and as an illuminant. However, only those within close proximity of the

Castings Act Both as Anchors and Joint Protectors

field used it for those purposes. During the past few years, natural gas has been exploited and large pipe lines have been laid from the fields to the consuming cities. Lines have been laid so fast that maps showing locations a year ago now are obsolete. Natural gas has been piped from Louisiana to St. Louis and a large line is being projected to Chicago. Many difficulties are encountered in constructing gas lines. River and marsh crossings are extremely difficult and would be more so if it were not for the castings that are used for anchoring the pipe in position. The accompanying illustration shows four pipe lines being laid across the Mississippi river. This particular line was made of screw pipe and each joint was provided with an 1800 pound river clamp as shown to anchor it in position in the river bed and also to protect the joint. Other lines are of welded construction but there also the river clamps were used. The castings are made of gray iron and vary in weight according to the size of the line and where they are used.

Find Where Castings Can Be Sold

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Examines Foundry

YEARS ago it was not such an uncommon practice for a small foundry to ascertain its costs by dividing the monthly or annual expenditure by the tonnage sold in the corresponding period and to consider the resulting figures as applicable, per ton, to all its products. If the owner can be assured that the various castings produced will always be required in the same proportions, for example, in the form of sets, this method may be quite adequate.

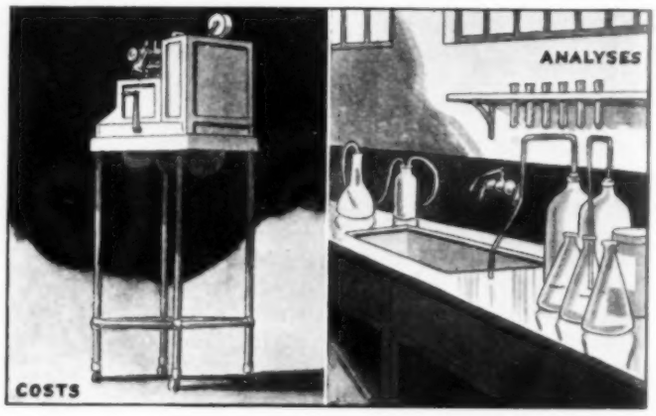
Cost systems applied to individual parts soon showed great differences in cost. The competitor, cognizant of this fact, takes advantage of his more ignorant brother by underbidding him on the work upon which he relied to produce sufficient excess profit to carry the losses on the more difficult work. The follower of averages thus finds his average costs continually rising due to losing that business which operated as a lowering factor.

The story is told merely to recall to the reader's mind the fact that average values, though useful, are not necessarily a safe guide for the future. When applied to a sufficiently diversified field (life insurance for instance), from which the causes of erratic discepancy are excluded carefully (by medical examination), the average expectation suffices admirably as a guide. Where each individual event is to be foretold, the average is nearly useless.

What information of importance can one gain from operating statistics beyond that disclosed by mere averaging of results? Let a few concrete problems be considered.

Suppose that in a given series of 1000 open-hearth heats made in a steel foundry the carbon content is distributed as shown in Table 1.

The data are translated into percentages and plotted on the peculiarly ruled cross section paper shown in Fig. 1. The abscissas (horizontally) are accumulated percentage of heats to and including a given carbon content shown as the corresponding ordinate (vertically). Such a series of points usually is found to represent, except perhaps at its extreme ends, a straight line. This is due to the fact that the designer of the paper arranged matters to give a straight line if the original data correspond to certain conditions usually found to exist; namely, that it is equally likely that a given heat chosen in advance at random will be found higher or lower than the average and that the likelihood of a given heat differing from the average decreases as the difference from the average increases. If the points then do form nearly a straight line, a first conclusion may be drawn that the remaining variations are not due to any one cause, but are the results of the accumulation of the many random variations of shop operations.



Let a second application be made. With melting conditions as they are, business is offered under specifications of a maximum and minimum carbon content. How large must the difference be in order that rejections from failure to meet the carbon specification may not be more than a given percentage of the metal, say 2 per cent? From the symmetry of the diagram this will mean a loss of 1 per cent due to high carbons and another 1 per cent due to low. We note the intersection of our plotted line with the ordinate erected at the 1 per cent and 99 per cent line of the diagram at the points a and b, finding the values to the 0.208 per cent carbon and 0.364 per cent carbon, respectively, the difference of 0.156, which is the carbon range

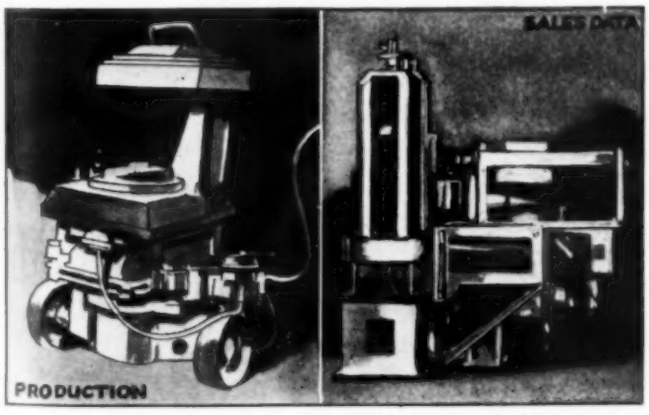
Figures Graphically

By H. A. Schwartz

corresponding to 98 per cent chemical acceptance if the melting practice remains unchanged.

If the range is narrower, we lose a greater percentage, thus—What percentage of heats will be rejected if the tolerance is only 0.50 per cent, i, e., 0.025 per cent up or down from the average? In this case we merely note the intersection of our graph with the 50 per cent line and count up or down 0.025 from this point to the points c and d, drawing through these points horizontals intersecting the line at e and f respectively. We note that these two points correspond to 22 per cent and 78 per cent. The percentage of rejection is then 22 per cent for low carbon and 100—78 per cent = 22 per cent for high carbons, the total of which, as it should be, is twice the rejection for either cause alone.

Suppose now we have two melters running the furnaces on alternate shifts and suppose we plot separately the distribution of carbon content for each melter obtaining the lines *A* and *B* in Fig. 2. Evidently melter *A* keeps his heats within closer limits of composition than *B*, for the 90 per cent of all the former's heats, excluding the lowest and highest 5 per cent are within an 0.08 per cent carbon range, while the same percentage range of the latter's cover a spread of 0.16 per cent in carbon. Here the two men are producing the same average composition of metal, for their two lines intersect at the 50 per cent line, but *B* would cause more rejections from chemical specification than *A*. Similar comparisons can be made between two furnaces or between day and night operation, etc. Evidently close control is represented in these diagrams by an approach of the lines to the horizontal and we may measure precision of control by measuring the slope of the line.



The scientist calls this *probable error* and for good but uninteresting reasons so defines probable error that we may obtain it from the diagram by noting the rise of the line in a 25 per cent interval. In Fig. 2 *A's* probable error is the rise from the value $C = 0.300$ per cent at 50 per cent to $C = 0.316$ per cent at 75 per cent or 0.016 per cent carbon, while *B's* is similarly 0.032 per cent carbon. A relation following this definition is that one-half of all the heats have a composition varying from the average by less than the probable error, hence the term.

Such charts can be used to check the work of the chemist. Let the chief chemist make it his business to check occasionally any result differing by definitely more than the probable error from the desired average value selecting say every heat which differs from the average by one and one-half times this error. Since carbon usually is reported to 0.01 per cent, there will be normally, according to Fig. 3, 12 per cent of the heats having a carbon content of exactly this content, one-half with values below the average, one-half with values above.

*****The data are translated into percentages and plotted***. Such a series of points usually is found to represent except at its extreme ends, a straight line.**

□ □ □

******It is equally likely that a given heat chosen in advance at random will be found higher or lower than the average, and that the likelihood of a given heat differing from the average decreases as the difference from the average increases.**

□ □ □

*****How large must the difference be in order that rejections from failure to meet carbon specifications may not be greater than a given percentage of the metal, say 2 per cent?**

□ □ □

*****Such charts can be used to check the work of the chemist.**

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*****A similar use can be made of such methods in determining the reliability of data received from outside sources.**

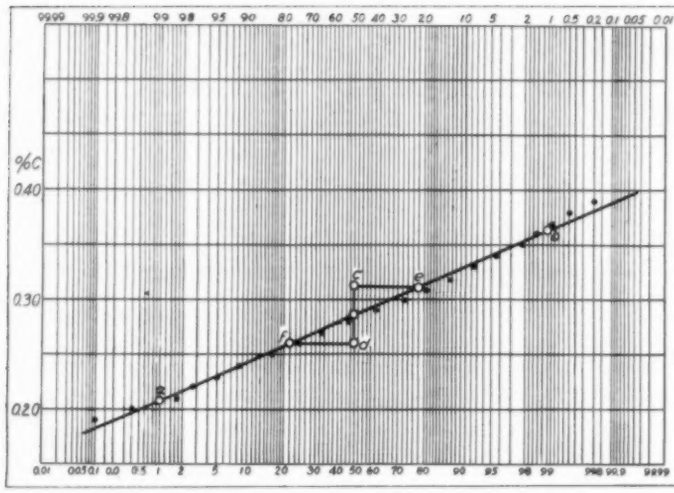


Fig. 1—Distribution of carbon Content in a Series of Open-hearth Steel Heats.

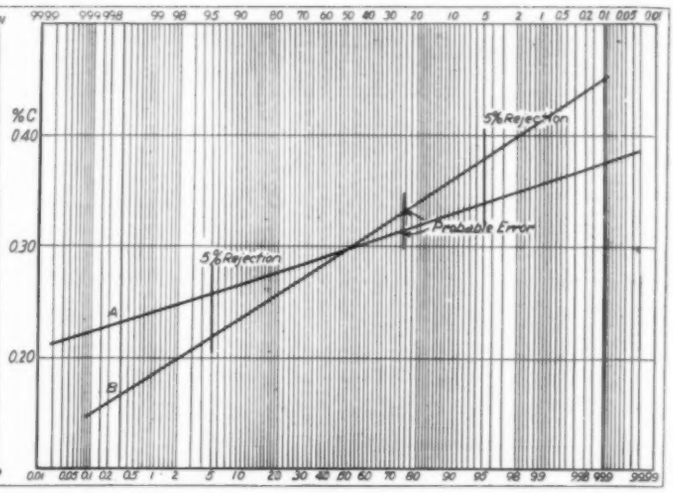


Fig. 2—Comparison of Two Melters

The percentage is determined by noting the pecentage interval required for a rise of 0.01 per cent carbon by the graph at this selected point, i. e., from the point a to the point b in Fig. 3. The previously mentioned percentage of heats does not involve excessive checking.

Suppose now the night analyst prefers to sleep rather than analyze iron and to write out his analyses by inspiration. What is he to do? If ignorant, he merely will limit his guesses to values near the known desired average and produce reports grouping his results as shown in Table II.

Show Poor Confirmation

These results when plotted show poor conformation to a straight line and a grouping which does not extend nearly across the known range of composition. Such a one is caught easily. Even if the analyst be a mathematician, he cannot *beat the game.* Knowing the distribution curve of Fig. 3, he could with enough patience, distribute his results in accordance with this curve, but must then include the right relative proportion of the value which will check. If he seeks to escape checking by omitting this particular value, its absence will be noticed at once. If he puts it in, what are the chances of getting caught?

Suppose a discrepancy of 0.02 per cent on recheck would be investigated further; the percentage of the total number of heats having normally a composition between 0.01 per cent more or less than one and one-half times the probable error from the average is represented by the difference on the horizontal scale between the points *c* and *d*, situated respectively at the limits of this range of composition. The guesser's chance of being right by accident beyond the limits of detection are thus 12 in 100, even when he is perfectly expert. The cruder type has no chance of escape and the writer has actually caught and punished trickery by the application of these principles.

A similar use can be made of such methods in determining the reliability of data received from outside sources. The variation in elongation of malleable test bars of a given carbon content (before anneal) is as shown by the black dots of Fig. 4. The data are based on the results on 100 heats from each of nine manufacturers and, as is to be expected, fall closely upon a straight line except for a limited number near the low end. This proves the distribution between different values of the tensile strength to be normal.

A certain individual submitted data which show a distribution in accordance with the open circles in which the first elongation recorded (15 per cent) represents 14 per cent of the entire number of heats. In view of the close agreement of the remainder of the data with the results of the large group and the sudden termination of the curve to the left of 15 per cent elongation, the writer is morally certain that all values less than 16 per cent either were raised arbitrarily to that figure or else that retesting was continued until some bar finally did reach that value, i. e., selection was used in the data.

Would be Horizontal

Had the result been attained by testing many bars from *every heat*, not only from the abnormally weak ones, and reporting always the best elongation obtained, the circles would have arranged themselves in a straight line more nearly horizontal and above the normal line derived from the basic large group.

A given malleable operation produced the distribution of composition shown by line *A* in Fig. 5 which is a fair approach to the so-called nor-

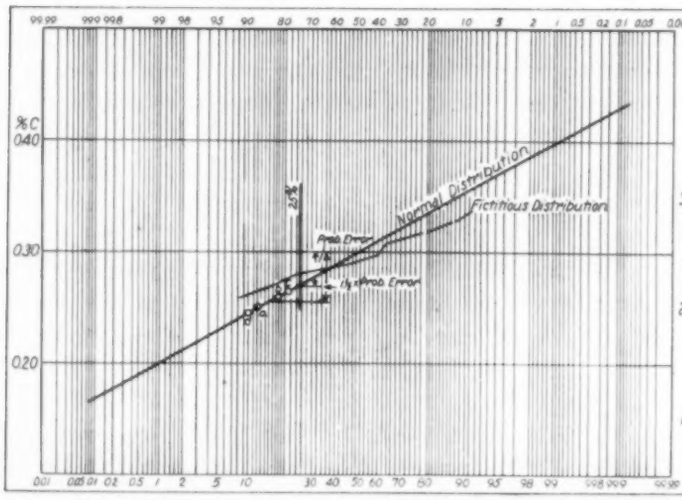


Fig. 3—Detection of Falsified Analyses.

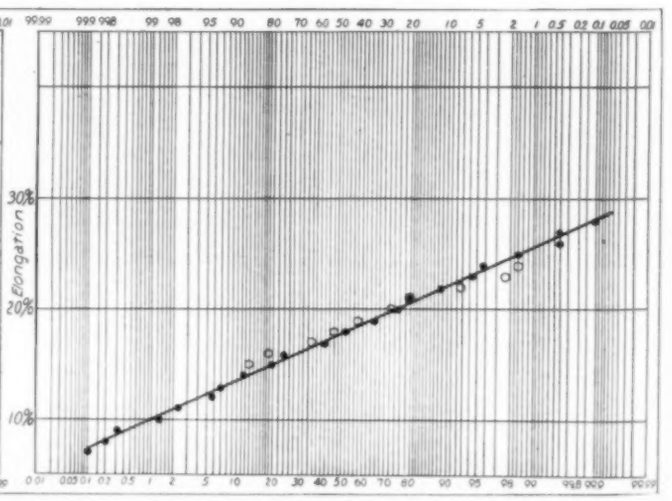


Fig. 4—Evidence of a Falsified Report on Elongation of Malleable Cast Iron

Table I

Open Hearth Heats

Carbon Content	Number of Heats
0.19	1
0.20	3
0.21	13
0.22	9
0.23	23
0.24	34
0.25	80
0.26	96
0.27	89
0.28	124
0.29	123
0.30	126
0.31	88
0.32	69
0.33	45
0.34	32
0.35	23
0.36	8
0.37	5
0.38	4
0.39	3
0.42	2
Total	1000

mal distribution. Another similar operation produced the results shown by line *B*. Evidently the two produced pretty nearly the same average result and differ trivially compared to the total spread, but *B* shows too few cases near the middle or median from 2.35 to 2.55 per cent carbon and too many in the immediately adjacent groups as shown by that line being relatively too steep near the middle and too flat immediately each side of the middle.

This discrepancy caused an investigation disclosing that while at *A* it was the practice after preliminary analysis to make such adjustments as were required apparently to bring the results to the desired mean value; at *B* the additions were calculated as sufficient only to bring the results within a certain permissable tolerance. The slight dip in *A* at 67 per cent is due to the absence of any adjustment on heats within a few points of the desired value. Metal produced by *A* was much the more uniform, while *B's* practice was cheaper. A disclosure of the differences unknown to the management permitted a judgment as to which was the more desirable practice, an end not to be achieved without a consideration of the distribution of results.

The preceding illustrations have been chosen largely from metallurgical applications in view of the writer's personal interests. The methods apply equally in many other fields which may be briefly indicated. The daily production of molds from given equipment by piece workers is subject to random variations and if a graph is drawn showing the daily production of molds distributed in the manner already described, nearly a straight line should be obtained.

If, however, in order not to *break* the price, the worker purposely or under pressure from others, refrains from making more than a set number, the graph will approximate a straight line in the region of lower production and then become nearly horizontal at or near the arbitrarily set limit. The graphing of production data in this way, especially if several men on the same job can be studied, will serve to detect a wilful limiting of production. When men purposely limit their weekly earnings, a graph based on the fluctuations in earnings will show a similar flattening above the individual's or group's predetermined amount.

Determine Workers' Merits

Again similar data can be plotted from the variations in tool life to determine uniformity of product machined. Another personnel application is as a means of distinguishing between the merits of the plodding and erratic type of workman. Economic pressure may perhaps force the latter to maintain some particular minimum or average earnings but being temperamental, his production of good work is variable. His line as shown in such figures as have been considered, is steep, while the steady going plodder, producing nearly the same output every day, is represented by a nearly horizontal line, as represented in Fig. 6.

Let us assume that the lines representing performance are equally applicable to the first day and to succeeding days. The lines for two men would not cross ordinarily at 50 per cent. In this particular illustration they are so taken from a desire to compare two men whose average is the same.

Table II

Carbon Content

0.30	0.30
0.28	0.28
0.29	0.32
0.32	0.27
0.35	0.35
0.26	0.33
0.30	0.26
0.29	0.27
0.33	0.29
0.34	0.32
0.31	0.31
0.29	0.29
	0.30

Suppose now we have an important short order representing only one or two days' work to turn out in a minimum time. To which man shall we give it? If the daily production rate required be represented by the line, *a*, evidently there is no hope of the plodder finishing the order on time, for he never attains that rate. However, *B* exceeds it in 15 per cent of the days he works and the chance of his finishing the order on time is therefore 15 in 100.

If, by the offer of a premium, extra supervision, or what not, we can spur him up into the upper 15 per cent of his place, i. e., insure that the particular days in question we will get our job on time, while *A* will certainly fail. For any required rate of daily production between *b* and *c*, there is some chance that either man will do the work, but *B's* chances are in each case better. Between *c* and *d*, however, i. e., at required rates below the average, *A* is more likely to meet the requirements, while for rates below *d*, there is no danger of *A's* failing, while *B* may do so unless we can drive him to the point of making sure he will not have an off day during the rush interval.

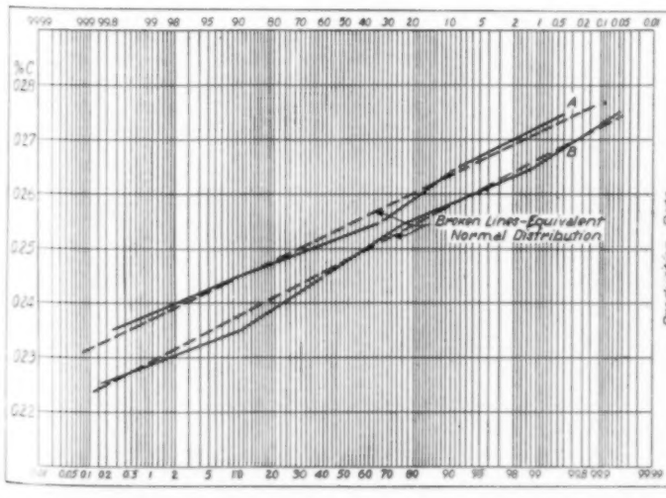


Fig. 5—Comparison of Two Principles of Furnace Control.

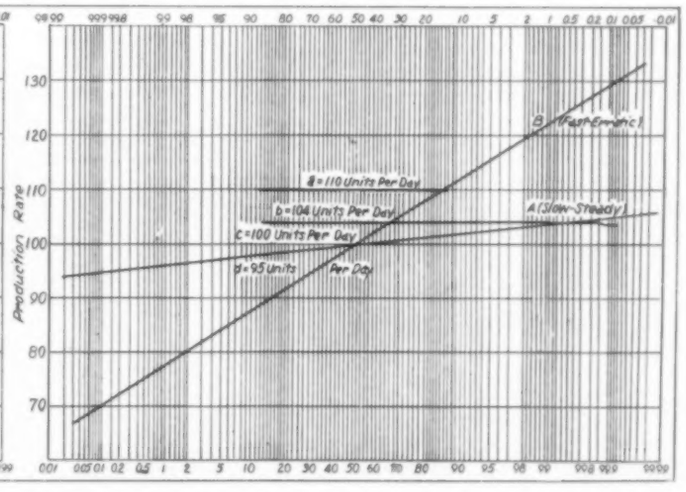


Fig. 6—Selection of Operatives for Production Work

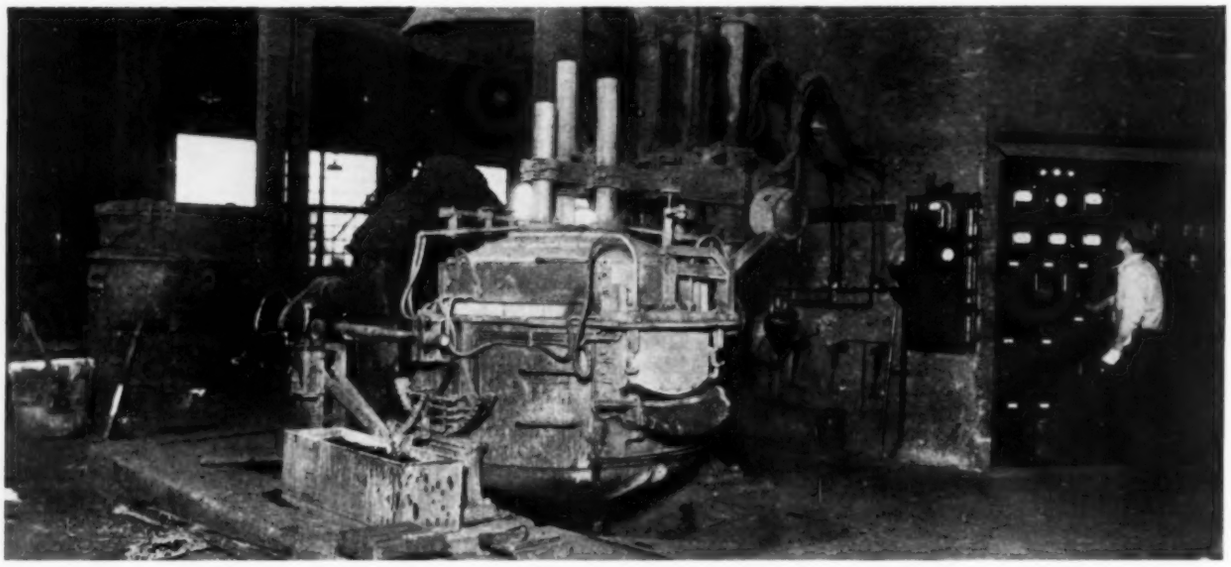


Fig. 1—The Electric Furnace Has Superseded the Home Made Converter Shown in the Background

MELTS IRON AND STEEL *in Electric Furnace*

By Gilbert S. Schaller

GRAY iron superheated in the furnace will produce castings with close grained structure usually associated with splendid resistance to wear. The author has verified this point through a series of approximately 60 heats in which pig iron was melted in an arc type electric furnace in the engineering shops at the University of Washington, Seattle. The iron was melted over the complete range of temperatures and with various degrees of superheat.

Many other qualities of electrically melted gray iron recommend it for serious consideration but the cost of production militates against its more general adoption. This especially is true in the East. In the Pacific Northwest, electrically melted gray iron shows up favorably due to a combination of economic factors. Washington is the only Pacific coast state that has coal deposits. Utah produces coal and coke, but is not, strictly speaking, a Pacific Coast state. Coke orginating in that section can be landed in the Pacific Northwest only after an expensive freight haul of 1000 miles or more over the mountains.

Some coke is manufactured in Washington, especially at Wilkinson where an installation of beehive ovens produces coke, used largely at the copper smelter at Tacoma. Most of the foundry coke is imported either from Vancouver Island, Canada, or Europe.

Cost of coke in the West is considerably higher than at eastern plants. At present coke is selling for about $14.50 per ton. This is one of the reasons why electric melting has received some attention. In

Low Costs Govern

ELECTRIC power is a cheap commodity in the state of Washington. At the Lidgerwood Pacific Co. plant, Tacoma, Wash., the average power consumption per ton of iron melted is 544 kilowatt hours at a rate that varies from 0.7 to 1.02 cents per kilowatt hour. Current quotation for coke in the district is $14.50 per ton. The bare cost of melting does not furnish a fair criterion. Low casting losses and flexibility of the process are important factors. The author is associate professor of shop engineering, University of Washington, Seattle.

Fig. 2—Gray Iron for This 30-Ton Shipment of Pipe Specials Was Melted in the Electric Furnace

power costs, a much more intricate problem is presented, due to the necessity of basing power rates on the demand shown by the furnace during a given month. A definite series of sliding scale reductions is based upon actual consumption figures. By lowering the demand and at the same time increasing consumption an actual lower melting cost per ton is achieved.

Electrical power is a cheap commodity in Washington. That state contains approximately one fifth of the potential hydroelectric power in the United States. The city of Tacoma operates two hydroelectrical plants: one of them located at La Grande in the Cascades, and the other at Lake Cushman in the Olympics. A further development is going in at Hoods Port, a completion of the Lake Cushman development. In addition to its hydroelectric plants, Tacoma maintains a small auxiliary steam plant.

An analogous situation obtains in Seattle, where the city lighting department operates two hydroelectric developments. The Puget Sound Power and Light Co., a private corporation, also serves Tacoma with electrical power. As a result of this abundance of power generated by water, the costs are favorable for melting. This feature is exemplified at the plant of the Lidgerwood Pacific Co., Tacoma, Wash.

Caters to Logging Industry

This company, an affiliate of the Lidgerwood Mfg. Co., New York, was founded in Tacoma, in 1895, and operated as the Puget Sound Iron & Steel Works until 1926, when the present company was formed. In common with many of the larger iron and steel working plants in the Pacific Northwest, most of its products, including steam and diesel engines are for the logging and affiliated industries.

The plant occupies a site of 10 acres, located on the Puyallup river, which affords docking facilities during favorable tide conditions. A siding of the Northern Pacific railroad and one of the Chicago, Milwaukee, St. Paul & Pacific railroad parallel the main axis of the plant. The building includes a large, well-equipped pattern shop and a large fire-proof pattern storage building in which the patterns are indexed accurately and stored for immediate withdrawal to the foundry. This pattern storage is equipped with a sprinkler system and fire resisting partitions.

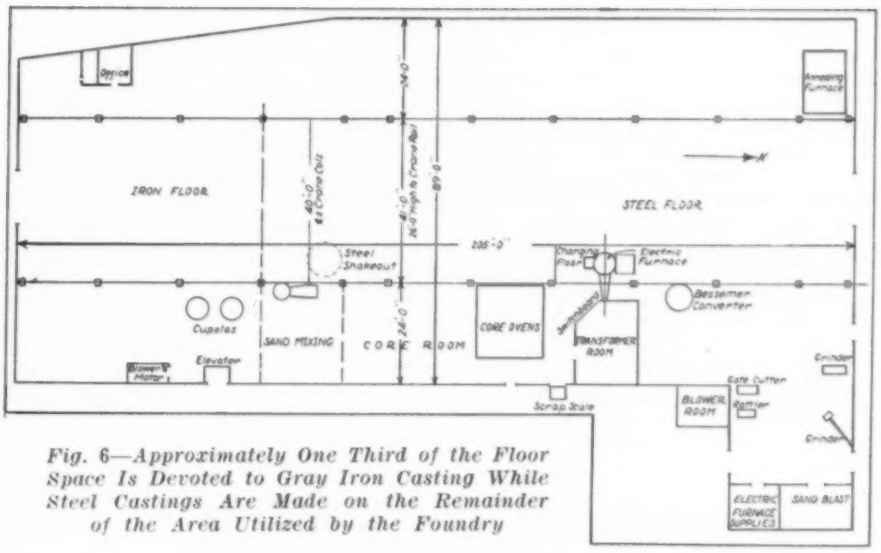


Fig. 6—Approximately One Third of the Floor Space Is Devoted to Gray Iron Casting While Steel Castings Are Made on the Remainder of the Area Utilized by the Foundry

Surrounding the pattern storage is the flask storage yard equipped with narrow gage trackage and also crane facilities for handling the large flasks. The foundry building adjoins this storage yard. Between the foundry and the machine shop is a casting storage for raw castings. The machine shop building in addition to a wide range of diversified machine tools contains facilities for erection. On one end of the machine shop is a structural steel shop as well as a forge shop equipped with steam hammers, bulldozers and other forging equipment. A finished parts storeroom and complete tool cribs are features of the machine shop. The office building is located across the street from the machine shop and houses the engineering and testing laboratory in addition to the administrative offices.

The foundry building 89 x 205 is of steel construction with sheet steel siding. This type of construction is common in the Pacific Northwest, where it is rarely necessary to heat the buildings in winter. The foundry building has a monitor roof and below this is a crane runway on which a 10-ton and an 8-ton, three-motor, cab-operated, cranes are placed. One of these cranes was made by the Shaw Crane Co., Muskegon, Mich., the other by the Shepard Niles Crane & Hoist Corp., Philadelphia.

On one side of the main molding bay are molding floors devoted to light bench and machine molding. The bay directly opposite is given over to the melting units, cleaning and core departments.

Use Various Melting Units

Melting units include a 48-inch cupola made by the Whiting Corp., Harvey, Ill., a 36-inch cupola made by the Titgen-Eastwood Co., Philadelphia, an electric furnace made by the Pittsburgh Electric Furnace Co., and a side blow converter. This converter was constructed by the company some time ago to meet the demand for steel castings. It has been augmented recently by the electric furnace. The scrap yard located just outside the foundry building is served by the sidings previously mentioned. Scrap is unloaded into bins so that a segregation of the scrap can be controlled accurately. The cupola charges are made up in the

Fig. 3 (Left)—Pig Remelted Without Scrap Addition at Temperature of 2950 Degrees Fahr., Unetched, 100X. Fig. 4 (Center)—Fracture Appearance of Standard Electric Iron Test Bar Unetched and Unpolished. Fig. 5 (Right)—Ordinary Run of Cupola Melted Gray Iron, 100X

scrap yard and taken to the charging floor on elevators. Charges for the electric furnace are carried on industrial trucks from the scrap yard to the furnace.

The company's products use both iron and steel castings, consequently about two thirds of the foundry floor space is devoted to steel castings and the other third to gray iron. The steel casting sand is prepared in a mixer made by the National Engineering Co., Chicago. The sand is for the most part Belgian silica sand to which local fire clay is added. For the iron molding floors, local foundry sands are used. At present the company is using sand obtained a short distance from Tacoma. A number of gyratory riddles are used in the preparation of the iron molding sand, which is divided into heaps for the various molders.

Two large car-type coke fired core ovens are used also for mold drying. A small drawer type oven is rather unique in that it is fired with a sawdust burner. This type of firing while entirely new seems to result in an even heat and without any apparent fumes or gases. The sawdust burner is located on the end of the oven and consists of a hopper into which the bulk sawdust is poured. Then it passes over an inclined perforated grate on which the burning takes place. The hot gas then is conducted into the bottom of the core oven. There is one other similar installation in one of the Tacoma foundries. Sawdust is a waste product of the sawmills in this region and is an extremely cheap fuel.

On the opposite end of the foundry are the cleaning rooms and annealing ovens. The cleaning room is equipped with a sandblast room installed by the Pangborn Corp., Hagerstown, Md. There are also the usual tumblers, grinders and chipping appurtenances. For the removal of the large steel risers cutting torches are employed. The new petroleum gas is being used somewhat in this connection as a substitute for acetylene. The annealing oven is equipped with two oil burners located at the top of the oven. The castings are placed upon a car which is pushed into the oven where careful temperature control is observed. To handle this there are thermocouples located in three different points within the furnace. These in turn are connected with an indicating type pyrometer.

The output is extremely diversified, therefore there is little foundry work of a repetitive nature to be found that will lend itself to a straight-line production program. For the most part, the molding program is similar to that of any jobbing shop.

Introduction of larger capacity logging units made it necessary for the company to install additional steel making equipment. Up until 1926 the converter was relied upon exclusively. Since that time a one-ton acid lined furnace has been installed. Soon after the installation the company became interested in electric gray iron castings. A program has been worked out whereby the furnace is used for both iron and steel heats as occasion demands. Iron for most of the castings now is melted in the electric furnace.

An interesting feature of the electric furnace is that the roof is made of fire brick. It is claimed that since fire clay bricks have been used on this furnace, the life period of the roof has been tripled. Approximately 125 heats were secured with a silica brick roof as against over 360 heats with fire brick. This experience duplicates the author's with firebrick lining in an electric furnace in the engineering shops at the University of Washington, for the past two years.

Although iron and steel heats are alternated there is little danger of a carbon pick-up from any cast iron remaining on the hearth. The steel heats are fairly high in carbon. Extreme care is exercised in the furnace operation to prevent holes or recesses forming in the hearth in which molten metal may become entrapped. When a cast iron heat follows a steel heat, of course no fear of contamination exists. The following charge is used for a cast iron heat:

	Pounds
Pig iron	1500
Machinery Scrap	3000
Gates	500
Steel Scrap	500
Charcoal	40

Charcoal is scattered well through the metal charges and is put into the furnace to assist in holding an arc stable. This is of considerable significance in connection with the power costs since the latter are based upon demand. By using charcoal instead of coke a clean hearth results. Charcoal is used also as a carburizing agent in heats where steel is made for casting purposes.

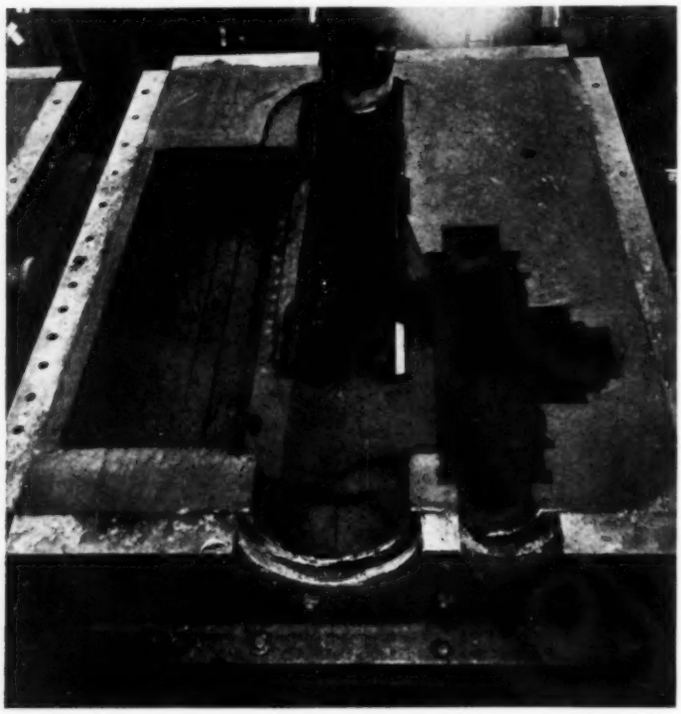


Fig. 7 (Left)—Engine Frames, Cylinders and Other Logging Machinery Castings Are Made From Electrically Melted Gray Iron. Fig. 8 (Right)—This Chart Carries All the Pertinent Data on the Operation of the Electric Furnace Over a Period of Two Years

Charcoal is obtained from a by-product wood distillation plant located at Eatonville, Washington. Douglas fir is treated in a manner analogous to the by-product manufacture of coke. However, the plant is operated primarily for the by-products and the charcoal actually is a waste material. A tremendous volume of charcoal is available from this plant for which practically no market exists locally.

Boiler plate scrap is the principal material used on all steel heats. To bring up the carbon content some pig iron is charged. Most of the pig iron comes from the blast furnace at Provo, Utah. Occasionally some foreign pig iron is offered on this market, but the quantity has diminished materially since the Utah iron became available.

Charge Sand and Slag

In working a steel heat, some old slag and sand are charged to build up proper slag conditions within the furnace. Gates and risers are charged uncleaned for the same reason. Ferromanganese is employed largely as a deoxidizer. Small ferrosilicon additions are made. Some ferromanganese is produced in this territory, from a manganese mine in the Olympic peninsula.

A typical steel charge is made up as follows:

	Pounds
Boiler Scrap	1200
Gates and Risers	800
80% Ferromanganese	20
Ferrosilicon	5

Usual time required for bringing down a heat is about one hour. The first heat of the day from a cold furnace requires approximately 1½ hours. Some alloy steel heats are made in addition to the relatively high carbon steel. Gear blanks and kindred castings on logging engines are poured from a chrome nickel alloy steel. High manganese heats are made occasionally for casting sheaves for logging blocks.

All steel castings, after cleaning, are subjected to a most exacting heat treatment. The temperature is controlled through a narrow range by a pyrometer installation.

To check up on physical properties of the various castings, the company maintains its own physical testing laboratory. Practically all alloy steel heats are tested here through test bars or coupons. These tests are applied before and after heat treatment to insure a close control of the product. Every heat is given a number and the test bars carry this number so that a complete history of the castings is available in the event any question arises later about the original casting specifications.

A typical analysis for alloy steel castings follows:

	Per cent
Carbon	0.60
Nickel	3.00
Chromium	1.00
Manganese	1.25

These heats are tapped at a temperature of approximately 2700 to 2800 degrees Fahr. The molding practice does not vary from that for carbon steel castings. The metal is poured from teapot ladles.

Charges for cast iron heats in the electric furnace are made up similiar to cupola charges, yet the resulting castings exhibit different characteristics. Cylinder castings made from this iron superheated to about 2700 degrees, have given excellent service. These results are expected from close grained iron which is a definite characteristic of the electric melting process.

Power consumption per ton of iron melted averages about 554 kilowatt hours. The actual cost per kilowatt varies between 0.7 cent and 1.02 cents. These costs of course can be revised further during a month of abnormal operation. Compared with a cupola, operating for example, on $6.00 coke with a melting ratio of, say 8 to 1, it can readily be seen that electric melting costs are higher even though other things are equal.

Improves Iron Properties

However, the bare cost of melting is not a fair criterion for measuring cost of electrically melted gray iron. In addition to improved physical properties and lower casting losses, the flexibility of the process must be considered. A change from steel to gray iron or the reverse, and the rapidity with which heats are melted, gives the Lidgerwood Pacific Co., an outstanding means of rendering its customers a complete casting service.

A modern and thoroughly equipped machine shop adds to the effectiveness of the plant, since many contracts involve both castings and machine work. The cast iron pipe and fittings shown in one of the accompanying illustrations, recently were completed for the Shuffleton power plant of the Puget Sound Power and Light Co.

Jobs are carried through from the drafting room to the shipping stage. In this instance the drawings, patterns, castings and machine work were attended to in the company's plant. The molds were made in iron flasks and were poured from iron melted in the electric furnace.

Form 21—10 24 27 1000 S-K LIDGERWOOD PACIFIC CO.—ELEC. FURNACE RECORD

DATE 9-17-29 HEAT 1676 1 SHIFT IRON

	C	MN	P	S	SI		
SPECIFICATION							
ANALYSIS							

METER READING
TOTAL K. W. H. 1200
K. W. H. PER TON 436
K. W. DEMAND 240

NO. HEATS PRESENT LINING 117 ROOF 85
CONDITION OF ROOF G BOTTOM G SIDEWALLS G

CHARGE	WEIGHT
Pig Iron	1500
Gates & Risers	
Scrap	3500
Borings	
S. Scrap	500
Charcoal	40
Ferro Manganese	
Ferro Silicon	
Sand	
Ore	
Fire Clay	

REMARKS

BEGAN CHARGE 1 30 P.M. FIN. CHARGED 2 00 P.M.
CURRENT ON 200 P.M. TAPPED 505 P.M.
TIME OF HEAT 3 hr. 5 min.
REPORT MADE BY 3
CHECKED BY RWS

Fig. 10—Data Not Shown on This Report Card Transverse Strength 3780 Pounds Per Square Inch, 0.1-Inch Deflection and Tensile Strength 32350 Pounds per Square Inch

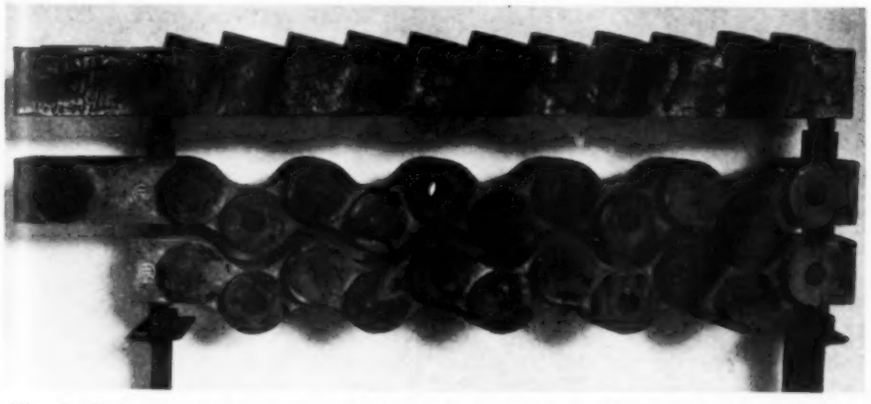


Fig. 9—Interesting Examples of Steel Boiler Head Castings 9 Feet in Length

SAND CONTROL
Increases Economy in the Foundry

Waste Molding Sand Reclaimed and Cleaning Room Sand Utilized for Manufacture of Molding Sand

By O. E. J. Abrahamson

SAND blending as distinguished from sand manufacture, that is, the mixing by various mechanical means of two or more grades of sand to obtain a product suitable for certain types of castings, has been practiced for many years, both by sand producers and sand consumers. Blending good molding sand from natural sands with different percentages of clay substances, and with grades of various sizes, offers relatively few difficulties, especially since the grains in these various sands all have a thinner or a thicker coating of clay and a mere cutting of the sands suffices to produce a fairly uniform molding sand.

Lacked Positive Methods

The scientific manufacture and control of molding sands on the other hand has offered a great many obstacles in the past, due chiefly to the lack of positive methods of analysis and tests and because the *feel* of the sand had to be used as the main criterion in judging its qualities.

However, just as mixing iron by analysis had to be preceded by a thorough knowledge of the chemical and physical proportions of the pig iron, cast scrap, steel and various ferroalloys used in the present-day foundry, so had the manufacture of molding sand to be preceded by intensive studies of the chemical and physical characteristics of various sands and clays. Consequently to obtain a more accurate knowledge of molding sands, their composition and behavior, various organizations, technical schools, universities, as well as private business enterprises have in recent years devoted a great deal of time and money to research in this promising field. As a result of this work some definite standard methods of testing molding sands have been developed.

Due to these methods of analysis, and due to the breaking down of a great many prejudices and traditions in regard to molding sands, a better perception as to what constitutes a good molding sand for different types of castings exists.

In the past it has been considered essential to have a fine sand from a seive analysis point of view to produce a smooth casting. However recent research work and investigations show that it is not altogether the absence of coarse material, that is, grains that are stopped on the 35, 65, 100-mesh sieves that determines the smoothness of a casting but rather the amount of fine materials or grains that pass a 300 mesh sieve, as well as the amount and nature of the bond, the moisture content and the preparation of the sand before it went into the mold.

Develops Field

THOROUGH investigation of molding sands has led to the development of synthetic sands which may be compounded from molding sands, clays, burnt sand, etc. It also has been found that the amount of fine material, amount and nature of the bond, moisture content and preparation of the sand are the governing factors in producing a fine surface on the casting. These and other important facts are discussed in this article which is the sixth of a series on sand control. The fifth article appeared in the July 15 issue.

Since all molding sands briefly are more or less perfect mixtures of grains of various sizes and shapes and bond, the latter composed of chemical colloidal clay, hydroxides, and oxides it may be seen readily that with a thorough understanding of the characteristics and influence of each of these ingredients upon a molding sand, a new field for the preparation of molding sands has been opened. A great many economies may be accomplished by the intelligent employment of what today is considered waste sands in the foundry. The day is not far away when the pushing of a wheel barrow of sand out in the dump will be held in the same regard as the dumping of a wheel barrow of iron just because it doesn't happen to be exactly the right analysis.

The requirements of a good molding sand may be enumerated as follows: The sand must have high enough permeability, to permit the air in the mold as well as the steam and gases generated when the mold is filled up with iron to escape readily, thereby preventing scabbing of the mold, as well as chilling and blowing of the iron. The permeability is dependent upon texture of sand, percentage of bond, the presence of carbon and organic substances, as well as upon the moisture and ramming.

The sand should *possess* sufficient bond to prevent dropping, washing, cutting, etc. and since the cohesiveness or bend depends in no small measure upon the percentage of moisture, the tempering of the sand should be made with the greatest possible care. Low or high bond sands as well as a wet or dry sand are condemned too often as inferior when with a proper amount of ramming they will prove satisfactory.

Uniform Bond Necessary

However, to avoid confusion and get the best possible results and the highest efficiencies in the foundry it is desirable to have a sand that has as uniform bond and temper as possible from day to day. The partial destruction of the bond when the molten iron comes in contact with and is allowed to remain in the mold until set and cooled, through the dehydration of the clayey part of the sand, will vary according to the thickness of the casting, length of time it remains in the mold, and upon the amount and nature of the bond. The destruction will be gradual, that is, the sand nearest the iron will lose most. Therefore, to keep the heaps from deteriorating, an equal amount of bond must be supplied daily either through the addition of a heavily bonded new sand or by using especially prepared high bond facing sands. The recent tendency is to eliminate facing sand wherever possible and the only

course left to maintain the integrity of the sand will be to add sands rich in bond or commercial bonding materials to the heaps.

However, it must be remembered, that in modern foundries with continuous molding, pouring and shaking out, the bond does not deteriorate so fast and therefore that it is not so much a case of rebonding the sand as it is a question of sand replacement. In other words, for every pound of castings produced a definite amount of molding sand is lost, either through dust collectors, adhering to the castings, in gangways, used for cupola bottoms or in a number of other ways. This sand has to be replaced by the addition of new sand, whether this sand be natural or manufactured, with a bond sufficient to maintain the bond on the floor or in the system at the desired percentage, as well as a grain structure that will permit the permeability to remain at a fixed point. These requirements for a suitable sand are secured and maintained readily with present knowledge of the behavior of sands and methods of control analysis.

As previously mentioned it is the amount of extremely fine grains present in the molding sand that is the chief governing factor as to the permeability of the sand as well as the smoothness or surface condition of the casting. This characteristic of the sand makes it possible to employ relatively coarse sands for a base in the manufacture of molding sands and the subsequent control of permeability and bond by varying additions of fine molding sand and clay.

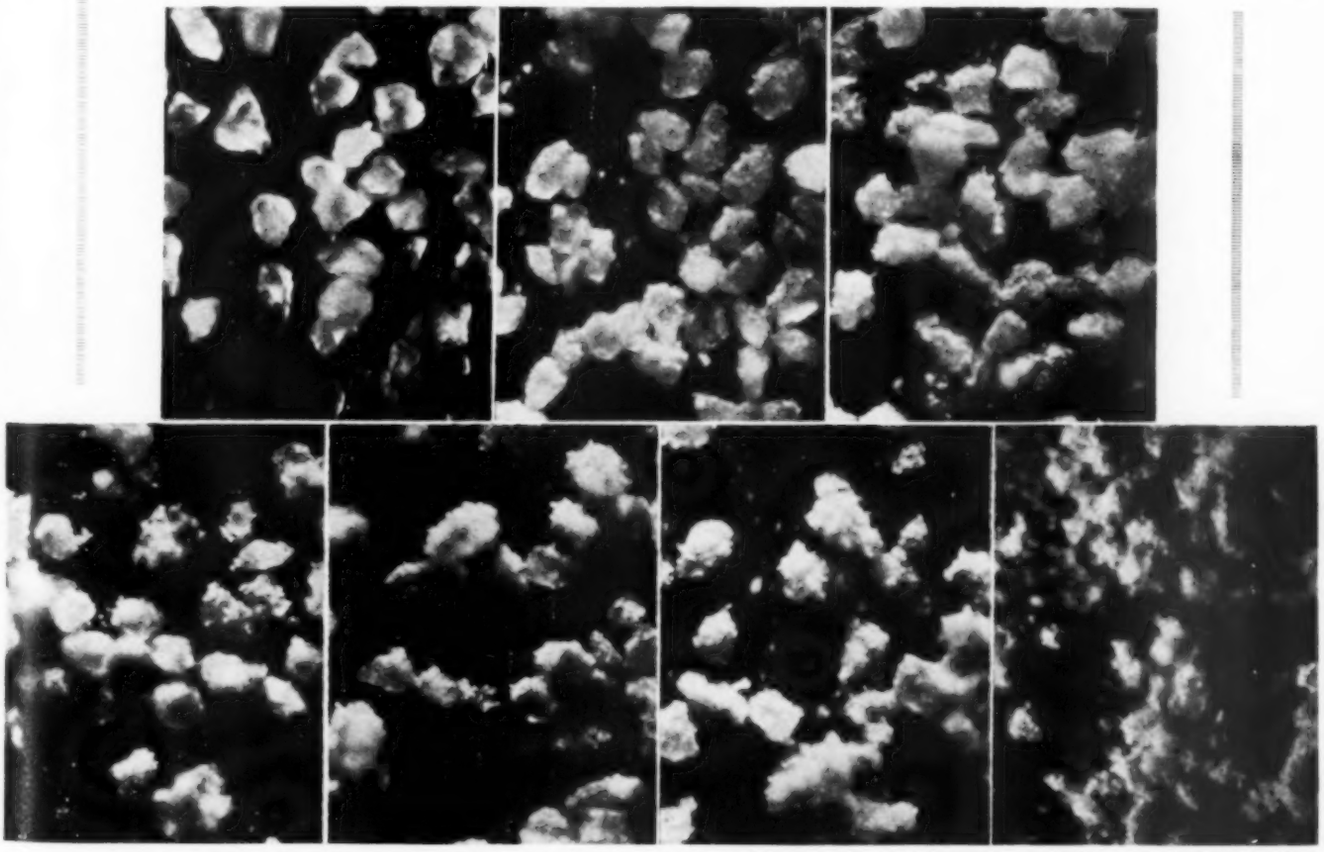
Early experiments in 1924 and subsequent practice in two large foundries, show that 70 to 75 per cent of a clean grained sand such as used in core making with a trace on the 20 mesh sieve and 75 per cent or more on the 65 mesh sieve with 20 to 25 per cent of a fairly refractory clay with an actual bond content of between 40 and 60 per cent, and from 0 to 10 per cent of a fine medium bond sand makes an ideal molding sand for medium weight castings.

Tests were run for a period of several months at one of these plants with a mixture containing 75 per cent coarse core sand; 20 per cent clay (dug on premises), and 5 per cent fine molding sand (containing 6 per cent bond with good results both as to losses and appearance of product. At the same time an economy of $5.00 per ton of sand was obtained since the sand used previously had to be shipped a considerable distance and therefore carried high

Table XXI

Costs of Synthetic Sand Mixture

Surface Clay (20 per cent water) delivered and unloaded, per ton $2.00	
Medium Sand (5 per cent water) delivered and unloaded, per ton $2.00	
Surface Clay 18.4 per cent (dry) = 21.9 per cent (wet) × $2.00 ..... =	$0.438
Medium Sand 9.2 per cent (dry) = 9.3 per cent (wet) × $2.00 =	0.186
	$0.624
Cost of mixing, labor, equipment, upkeep, depreciation, etc.....	0.300
Total	$0.924
Cost of disposal of cleaning room sand including loading, switching and dumping was about $1.00 per ton. Therefore by subtracting	
Cleaning room sand 72.4 per cent (dry) = 68.9 per cent (wet) × $1.00 ..... =	0.689
Cost of sand per ton	$0.235



Top Row, Left to Right—Fig. 43—*Sand Without Bond Through* 200 *Mesh and on* 270 *Mesh. Fig.* 44—*Same with* 5 *Per Cent Bond. Fig.* 45—*Same as Fig.* 43 *with* 10 *Per Cent Bond. Bottom Row, Left to Right—Fig.* 46—*Sand Through* 200 *Mesh and on* 270 *Mesh Screen with* 15 *Per Cent Bond. Fig.* 47—*Sand with* 20 *Per Cent Bond. Fig.* 48—*Sand with* 25 *Per Cent Bond. Fig.* 49—*Sand with* 30 *Per Cent Bond*

freight charges. Later on the coarse core sand was substituted with cleaning room sand or burnt core sand entailing still further savings, and this practice is still in operation.

Substantial economies have been effected at the other foundry referred to by utilizing cleaning room sand, or burnt core sand mixed with a small amount of molding sand for a base sand in the manufacture of molding sand. Tests were started at this foundry in 1925 by mixing cleaning room sand with a refractory clay containing on the average 35 per cent actual bond. The proportions used varied somewhat, depending on the condition of the particular heap for which the mixture was intended, from 25 to 33 per cent by volume of clay and from 67 to 75 per cent by volume of cleaning room sand.

At first the sand and clay were mixed dry in varying proportions, cut over with shovel, riddled, given preliminary temper, and added to the units in exactly the same manner as a new sand. Later on as the demand for this sand increased, due to its extended adoption, it was found necessary to employ paddle type mixer to secure a sufficient amount of mixed sand and clay at a minimum cost.

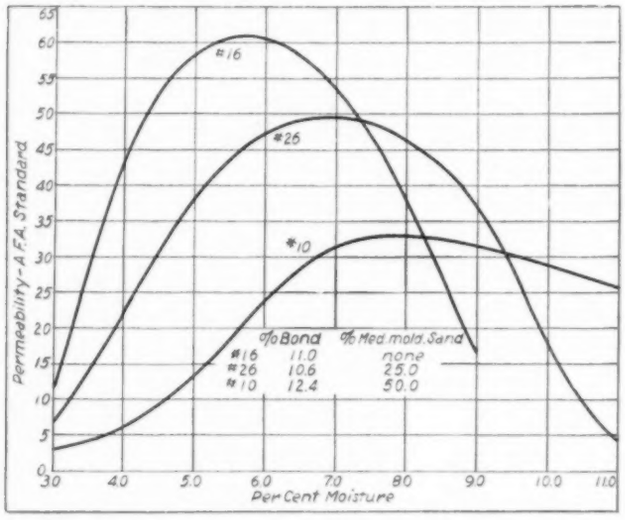
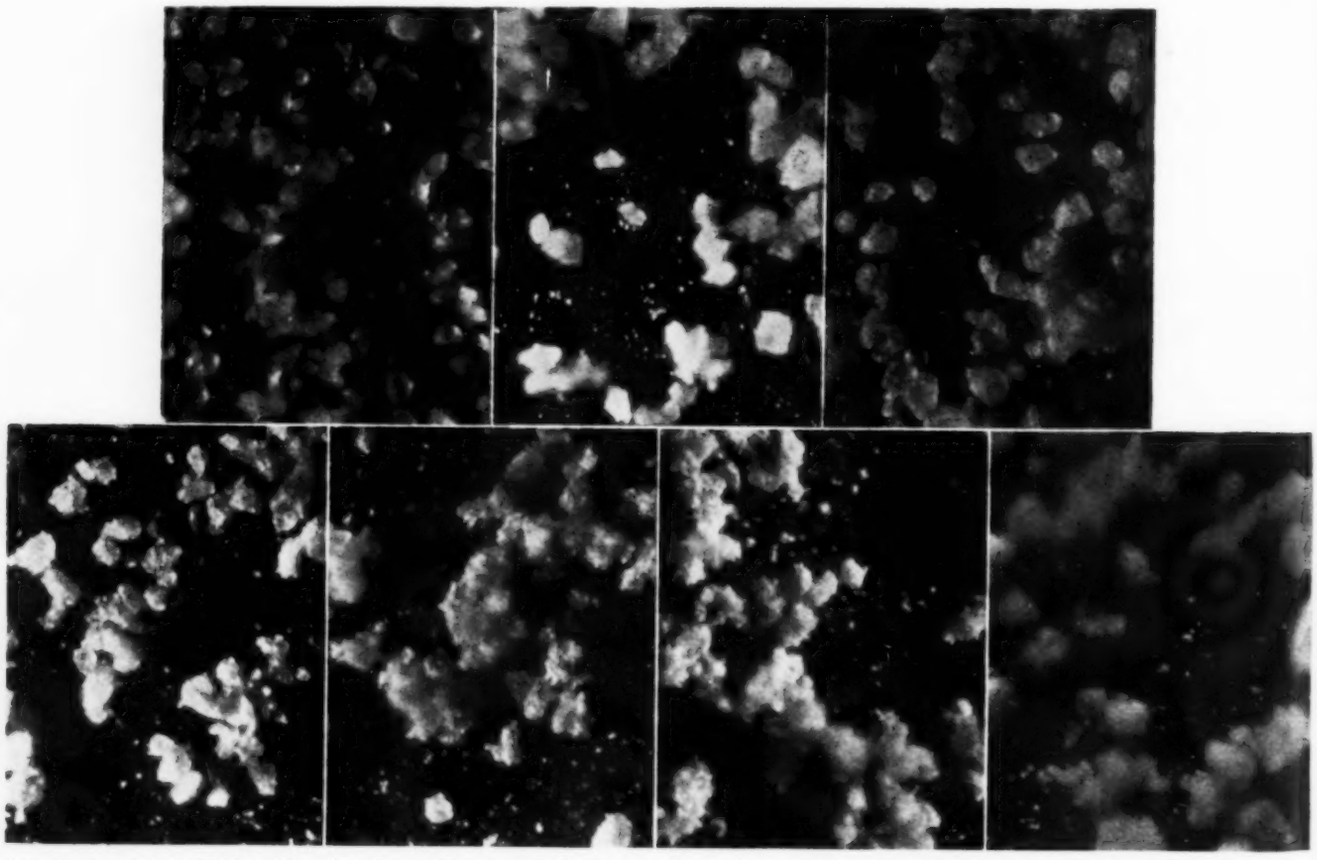


Fig. 57—Increase of Fine Molding Sand Permits Moisture Increase at the Expense of Permeability

Since mixing dry clay and cleaning room sand on a large scale produced a considerable amount of dust and proved to be quite a nuisance, from 4 to 5 per cent water was added to the mixture. That procedure eliminated the dust and incidentally produced a much better sand. The sand clay were mixed dry for about 3 minutes, the water added and mixing continued for 7 minutes more. The total mixing time was 10 minutes. Laboratory experiments show that the full value of the actual bond in the clay is obtained only when the clay and sand are mixed sloppy wet and then dried. However this method of mixing will prove cumbersome and expensive when mixing sands on a large scale.

Due to the increased demand for manufactured sand at that foundry in early 1926 and also due to the experiments conducted as to the best way of making the sand, a new sand preparing unit was built in which mullers were incorporated. In addition to the mullers the unit has two bins for cleaning room sand, one for each muller, both equipped with measuring hoppers.

In the meantime, the research department had been conducting tests on the availability of various clays for rebonding purposes and found that surface clay would do the



Top Row, Left to Right—Fig. 50—Sand Through 300 Mesh and on Pan, without Bond. Fig. 51—Sand with 5 Per Cent Bond. Fig. 52—Sand with 10 Per Cent Bond. Bottom Row, Left to Right—Fig. 53—Sand Through 300 Mesh and on Pan with 15 Per Cent Bond. Fig. 54—Sand with 20 Per Cent Bond. Fig. 55—Sand with 25 Per Cent Bond. Fig. 56—Sand with 30 Per Cent Bond

work in a satisfactory manner.

The only trouble encountered at first when using a raw surface clay was the difficulty of getting a thorough incorporation of the clay with the cleaning room sand. This was overcome readily by mixing the clay with water in an agitator, using sufficient water to make the mixture syrupy in consistency. This clay mixture added to the cleaning room sand in the mullers produced a well mixed, smooth sand. Since however, the clay and water mixture contained about 45 per cent water, a high bond sand could not be made in this manner, without making the sand too wet. Therefore it was found necessary when such sands were desired to add considerable amounts of dry powdered clay.

Finally, a method was developed that made it possible to produce a satisfactory molding sand using raw surface clay without any preliminary preparation. The method is briefly as follows:

The mullers used had capacities of about 24 cubic feet or 2400 pounds for the type sand that was made. However, to take care of emergencies, the batches were calculated for 2000 pounds of dry sand, which with 100 pounds of water and an equal amount of sea coal would make a batch weighing approximately 2200 pounds. Since the amount of cleaning room sand desired in the sand averaged 70 per cent, the measuring hoppers for this sand were calculated so that three hoppers full would give 70 per cent of 2000 or 1400 pounds or each hopper full 467 pounds. Actual weight of the sand in hopper after it was built came slightly lower or 420 pounds.

Assuming that the average sand mixture at the foundry in question expressed in weight consists of Cleaning room sand—(3 hoppers @ 420 lbs.) 1,260 pounds; surface clay (on dry basis) 320 pounds, molding sand, medium (on dry basis) 160 lbs, the procedure is as follows: First, all the clay and molding sand is taken plus one hopper of cleaning room sand, or 420 pounds and mixed thoroughly in the muller with sufficient water added to make the whole a stiff paste. The time required for this operation is about three minutes. However the longer mixed the better.

In this manner the clay is diluted and thoroughly incorporated. By adding two more hoppers or 840 pounds of cleaning room sand, which is dry, to the mixture, the water content is reduced to nearly the percentage required of the finished mixture. The addition of 100 or more pounds of sea coal—the amount varying depending on whether facing sand or backing sand is being made—leaves a sand with the desired moisture content.

In this way it was made possible to produce an excellent molding sand from cheap raw materials and the uniformity of the product is maintained readily by having the mullers in first class shape at all times. It may be mentioned in this connection that it was found advisable when using the muller for the above outlined purpose to bolt the plows to the plow arms and to equip the plow arm with a scraper that will keep the sides of the muller clean.

The cost per ton of mixed sand at this foundry is given in Table XXI.

Observe Seventy-Fifth Anniversary

A HANDSOME brochure of 62 pages, 8 x 12 inches and printed in English at the printing office of the Fried. Krupp Aktiengesellschaft in Essen, Germany, announces the 75th anniversary of the founding of an affiliated industry, the Grusonwerk in Magdeburg in 1855. Presumably other editions have been issued in many languages besides English and German. Hermann Gruson and Alfred Krupp had an international reputation while operating independent plants and the fame of the men and their products has not decreased since the amalgamation.

The Grusonwerk of Magdeburg was founded in 1855 by Hermann Gruson, an engineer of strong personality who began his career in the workshop and who had the advantage of the best technical education of the period. He spent short periods of service with Borsig & Wohlert, the Berlin-Hamburg railroad and the Hamburg-Magdeburg Steam Navigation Co., but he never temperamentally was fitted to occupy a subordinate position.

He was one of the first to develop hard cast iron for special purposes. Accidental tripping over a worn cast iron frog started him on a series of experiments which culminated in the development of chilled castings for various purposes.

The civil war in the United States started a new controversy over the relative merits of shell and armor and encouraged Gruson in the development of hard iron shell. His success in this line prompted the building of a new plant in 1869 and the continued expansion of this plant for many years.

In 1886 he had formed the works into an aktiengessellschaft, though still retaining active control. He still was at the head of affairs during the years in which events became critical. Krupps had taken up the manufacture of armor and Gruson the manufacture of guns. In finding fresh outlets, the two workers explored new paths which in certain instances inevitably crossed.

Healthy competition resulted and at first fostered progress. Later, this competition increased to a point where it interfered with economic operation. The fusion of interest long delayed eventually was effected. The name of the founder linked with that of Krupp was perpetuated in the new title, Fried. Krupp Grusonwerk, A. G., Magdeburg.

After the change the production of war material was transferred to Essen. The Magdeburg plant devoting itself to industrial activities. During the recent war the Grusonwerk again took up the manufacture of war material, but on the cessation of hostilities all this was stopped. Since that time production may be said to have been built on two main pillars: One the knowledge and experience in the manufacture of chilled and high strength iron inherited from Hermann Gruson; the other, the manufacture of high grade cast steel and special manganese steel, derived from the Krupp union.

Products of the present plant include crushing plants, road making machinery, salt and potassium chloride plants, plants for ore dressing and smelting, rolling mills for all metals, metal extrusion presses, cable and wire rope making machinery, machinery for handling rubber, celluloid, cork and linoleum, machines and equipment for powder and other explosive factories, plants for the recovery of oils and fats and treatment of tropical products, fiber baling presses, cranes, loading equipment, conveyors, hydraulic mechanisms, car wheels and general foundry castings.

Retires as Manager

Charles B. Spicer, resident manager, St. Louis office Hercules Powder Co., Wilmington, Del., has retired from active business after 43 years service. He began his career in 1887 as office boy for the Hazard Powder Co. and later became a salesman. He was appointed explosive agent at Pittsburg, Kan., and in 1913 was promoted to manager of the Pittsburgh office of the Hercules Powder Co. He occupied that position until 1921 when he was transferred to St. Louis as resident manager in charge of the Southwestern district. Mr. Spicer was born in St. Louis in 1869.

Frank B. Hamerly, Aurora, Ill., recently was elected vice president in charge of manufacturing of the Independent Pneumatic Tool Co., Chicago.

Steel Foundrymen Should Study PATTERN COSTS

By William Donnelly

THE question of who shall supply the patterns to a steel foundry and the responsibility for the condition of that equipment may appear to be a simple one. However, it is one that often is overlooked by the purchaser or foundryman in negotiating a sale or contract. The steel foundry salesman should be a trained foundryman, able to convince the customer of the necessity of good patterns designed to fit the job in the foundry. The nature of the pattern equipment is a prime factor in determining molding costs on a particular job.

When a steel casting is required, a drawing is made and the resulting blueprint may be sent to several foundries for price quotations on the castings. Many factors influence the awarding of the contract. However, assume that a foundry is given the contract at a low cost figure.

Pattern Is Important

During the consideration of the contract, the foundry often assumes that the pattern has been constructed and guess as to the type, whether it is loose or mounted, whether cores are used and where it is parted. However, the foundryman does not consider the completeness of the pattern, its suitability for economical production of castings of the quality, and quantity required; whether it is on match boards or whether rapping plates, draw plates or straps are included. As a result of overlooking these items, the foundry finds later that it has quoted a price too low because the pattern is not constructed as was anticipated.

Often the pattern submitted is not in first-class condition. The customer's shipping clerk, sensing this, does not use the utmost care in packing, with the result that the pattern arrives at the foundry with core prints missing, lugs broken off, and otherwise damaged. Blue prints that accompany the order for the castings, which always should be the case but frequently is not, often are not correct.

If the pattern is constructed poorly it is safe to assume that the core boxes are in a similar condition. Core boxes may have many defects such as loose dowel pins, lack of metal facing, cores not fitting, core prints necessitating filing, excessive chipping and grinding, half instead of full core boxes furnished, etc. These faults cause extra labor and increase the cost of production.

Many times after a few molds have been made a stop order is issued because the customer desires a change in design and the pattern must be taken off the floor for a time.

Cost of Repairs

MANY times the steel foundryman bears the cost of repairing pattern equipment that rightly should be charged to the customer. There also appears to be a wide divergence of opinion among steel foundrymen as to what constitutes good pattern equipment for any job. These points, and many others that often are overlooked when contracts for castings are accepted, are discussed in this article which is abstracted from a paper presented at a meeting of the small castings division of the Steel Founders' Society of America at Chicago. The author is connected with the Geo. H. Smith Steel Casting Co., Milwaukee.

This picture is a sorry one but is made up of a series of circumstances that easily may happen. In the first place, the foundry is given a poorly constructed pattern which promptly must be taken to the foundry's pattern shop to be trimmed, changed and bolstered. The expense of repairs usually is absorbed by the foundry as a part of doing business.

Steel foundries should operate the pattern shop as a separate business charging it as a department with all the overhead, such as rent, light, heat, power depreciation, maintenance, etc., and not consider it a part of the general foundry expense. It will be interesting for some foundrymen to check on that point with the accounting department. One foundryman investigated his pattern costs in 1925 and by distinguishing between pattern expenses that logically are chargeable to the customer and those that should be absorbed by the foundry, he was able to effect a saving of $30,000 in one year.

The second point is that the pattern arrived in a bad condition due to poor construction and packing. That case also necessitates the pattern being taken to the pattern shop for repairs. The repairs must be made hurriedly, since the order for the castings generally is liberally sprinkled with *Rush* and *Wanted at Once* labels. Any delay will hold up the order and necessitate explanatory telegrams, long distance calls, etc.

Should the foundryman notify the customer that the pattern arrived broken, file a claim with the carrier and wait for the adjuster, or have the pattern repaired? The order was marked *rush* which often determines his action. He decides not to notify the carrier, because he feels that it was a poor pattern and that it was packed improperly. He has the pattern repaired in his own shop, and probably forgets the overhead.

Placed Responsibility

Some foundrymen have stated that the only pattern expense that should be charged to the foundry is that of repairing patterns and core boxes damaged through foundry abuse or replacing lost patterns, core boxes or parts. These items should be strictly foundry expense and have been recognized as such for many years.

If the pattern equipment has been prepared under the supervision and according to the specifications of the foundry, it would seem reasonable that such equipment should be maintained against ordinary wear and tear by the foundry and considered a part of its overhead. That is a practice which is being followed by some of the larger foundries. The fact that some large and progressive organizations are following this practice makes it increasingly difficult to handle the situation with some customers. That is a serious problem and worthy of careful consideration.

Foundries should avoid fire risk, but since they do not own the patterns there is no valid reason for their providing insurance coverage. It generally is accepted that this is carried by the owner, and most foundrymen will testify that many of their owners carry insurance on patterns stored with the foundry.

The next point is that the pattern was accompanied by a blue print in which discrepancies were found. This should be an exception to the rule.

but unfortunately it is not. It is an unwritten code law that the foundry is responsible for trueness to pattern only when the foundry furnishes the pattern equipment, but the foundry also has an obligation to its customers in that respect. In event the pattern has been supplied by the customers, it still should be the duty of the foundry to check it carefully.

The order was marked *rush*, the pattern was poorly constructed, poorly packed, and did not check to the blue print. What does the average foundry do under these circumstances? Production departments are aware of the many causes of delay that can ensue all along the line in a steel foundry. They also are aware that any time lost, especially in getting the pattern ready for production, is synonymous to waiting before turning in a fire alarm which might result in a serious conflagration. The production manager begs, cajoles, or demands action from the patternmaker. It is a multiplication of these items of pattern expense, which some executive fails to scrutinize closely, together with the fear of losing the customer's business, that results in a large loss to the foundry.

Should Standardize Equipment

With reference particularly to pattern equipment for small steel castings, it seems that a certain amount of standardization of pattern boards and fittings could be made. Too many times the customer is confronted with the situation that his pattern shop or his pattern purchaser has wanted to co-operate with the steel foundry in connection with pattern equipment, but has lost faith in the suggestions and recommendations of foundries with which he has worked. There appears to be no consistency between foundrymen as to what constitutes proper pattern equipment for any job. One foundry, after studying blue prints carefully recommended that the equipment be furnished so that the mold could be made using cover cores and eliminating the cope. When the patterns arrived constructed as the foundry had specified, the foundry deliberately changed the equipment before it had produced any castings, making the cope in green sand and eliminating the cores.

Because of such treatment, many customers have arrived at the conclusion that each foundry wants different pattern equipment for the same job. Many customers are using their best judgement in making patterns which will meet most nearly the requirements of various foundries and feel they are better off in the long run to make the pattern equipment and then require the foundries use it. In adopting this course a customer generally secures cheap pattern equipment.

This is a competitive age, and every foundry must modernize its methods to reduce costs. It seems that the specifications for pattern equipment from any progressive steel foundry should be about the same for a given quantity of castings if the foundryman has a knowledge of future requirements and probable changes, and the resulting equipment should be made so that it can be used readily in any foundry. Unfortunately, the experience of many buyers has not been of this nature.

Foundry Should Specify

Steel foundries should either specify and lay out the pattern equipment or supervise its production to obtain the best results. Steel foundrymen must know that they are equipped to give that service to their customers. In many cases a customer can be shown that properly made pattern equipment does not cost more than the pattern equipment which he would furnish. There are many cases where patterns would cost less and insure better castings, lower costs and a much smaller maintenance expense.

Often the trouble with a customer's pattern equipment centers about the head of his pattern shop. The patternmaker may have had practical foundry experience and may supply what he considers good, substantial pattern equipment. This man must be made to realize that the proper co-operation from the foundry will not necessarily increase his pattern costs, but will reflect itself in savings to his company. Only a man who is conversant with both pattern equipment and foundry practice and who can talk to the patternmaker on a basis which he will respect, will make any headway.

Experience has shown that if contact can be made with the patternmaker in the right way he soon will come to an understanding and will welcome suggestions from the foundry. If he is of the stubborn type, it may be necessary to go to his superior to clear up the matter. Everybody is interested in saving money and the job of the average buyer is becoming increasingly important. If you can show him where he can save his firm money, he is going to fall in line with this program.

Pay Excessive Price

Some customers say that whenever they allow the foundry to co-operate with them to the extent of buying their pattern equipment from the foundry, they pay an enormous premium for such pattern work. The cost to the customer should not be greater than the cost when purchased through a well-equipped pattern shop. The practice of a foundry increasing the cost of the job because the pattern equipment was not made economically in its shop or not intelligently purchased outside of the foundry, and in addition adding a big profit on the job, is to be condemned as shortsighted practice.

Some customers have well-equipped pattern shops. The practice in that case should be to encourage the making of the pattern equipment in the customer's shop, but according to specifications furnished by the foundry. Any steel foundry worthy of the name should be able to make suggestions that will save the customer money.

The third assumption is that the pattern breaks after it has been given to the molder. That means a delay. The expense of delays should be charged to the customer. Generally, it is not. While foundries are not operated on a strictly straight line production plan, any stoppage of work increases costs, as other jobs must be substituted, cores must be stored, molds probably held on the floor, flasks set aside, etc.

Finally a stop order was issued by the customer because he desired to change the design. Different items of cost which result from changing schedule have been pointed out. When changes are requested the customer should be charged with the expense entailed due to the time lost by the molder and coremaker and the supervisory time required to route equipment out of the foundry to the pattern shop, assigning new jobs, etc. That also should apply to patterns broken because of poor construction rather than because of any abuse on the foundry's part. One foundryman who made a detailed time study has stated that in his experience these intangible items amount to just as much as the actual labor expended, especially on a repair job in the pattern shop.

Cleaning Costs Rise

Observe the result of poor pattern equipment in the cleaning room, in increased costs of that operation. Take into consideration the extra chipping, drifting, welding, and straightening, all due to the poorly constructed patterns or core boxes, and the delays necessitating telephone calls, telegrams, and excuses which probably will result in ill feeling on the part of the customer and the withdrawal of his equipment because a careless salesman of another concern has promised wonderful delivery on the order and thereby made it difficult not only for his foundry, but also for the customer, who in turn will go through many of the same experiences previously outlined.

Of course, the customer pays transportation charges on the pattern equipment, but how many foundries charge their customers with the cost of packing and crating patterns and trucking them to the depot or their destination? This is an expense which undoubtedly should be borne by the customer. It is common practice to return patterns held in storage for two years without an order.

Continuous Oven REDUCES CORE LOSSES

By J. B. Nealey

ONE of the greatest questions that American industry has faced is the elimination of waste. With the advent of high speed production and the necessity of paring production costs industry has adopted many new devices. The foundry industry has not failed to keep step with those advancements. Large automobile foundries have adopted methods and devices unheard of a few years ago.

In many foundries the core room was a department where at times a significant percentage of the product was unfit for use when all the operation on it were completed and it was to be placed in the mold. After some investigation, the continuous type core oven was developed to correct those evils and automobile companies have installed ovens of that type in several shops.

Investigate Oven Types

Studebaker Corp., South Bend, Ind., recently installed a counter flow, heat sealed, indirect heated, gas fired, two compartment, continuous type core oven to bake its crankcase cores, which utilizes a single heating unit. The oven was manufactured by the Swartwout oven division of the Foundry Equipment Co., Cleveland, and the heating unit was supplied by the Drying Systems Inc., Chicago. The conveyor equipment, oven platforms, heater platforms and all structural steel supports for ovens and conveyors were manufactured and supplied by J. B. Webb Co., Detroit.

The oven rests on columns 8⅛ feet above the floor. Coremakers and a black wash oven are located beneath. The oven is 120 feet long, 24 feet wide, and 7 feet high and is constructed of sheet steel panels with 4 inches of insulation. A monorail conveyor is used to transport the cores from the loading station beneath the oven, through the oven four times and then to the unloading station. Coremakers load the racks directly from their machines as the conveyor passes their floors. Racks for holding the cores are suspended from the conveyor chain by two, 4-wheel, ball bearing trolleys through a yoke.

Each compartment is divided into three sections longitudinally by two sheet steel partitions. Two lengths of the conveyor are inclosed in one partition while the other two lengths are in separate compartments. The conveyor thus enters the oven close to the outer side, travels through the first section, crosses the oven at the further end, returns to the fore end, doubles back in the same compartment as the second pass and finally returns through the third section. Heated air is forced into the larger of these sections, through a system of ducts. The other half of the oven is identical.

The ovens are open at the charging ends only and the hot air, after being utilized for drying and baking, is exhausted through ducts and motorized fans located at those ends. As considerable heat remains in the exhausted air, part of it is recirculated through the black wash oven and part through the heater. This combination of counterflow and recirculation raises the efficiency of this unit to a high point.

Describes Heating Unit

The heater consists of brick chambers divided into three sections. Two are combustion chambers and the third is a mixing chamber. Air is heated in the combustion chambers with gas supplied through burners and is drawn through the mixing chamber into a common duct which is divided into sections. One section runs into each of the two oven compartments. Hot air is mixed with fresh and recirculated air in the mixing chamber to obtain the proper temperature. Each main heat duct is connected to an independently operated fan so that one compartment of the oven can be used independently of the other. The possible operating temperature range of the hot air is from 400 to 500 degrees Fahr., varying with the load. The oven is maintained at the desired temperature by automatic temperature control. Gas consumption is in direct proportion to the load. The conveyors operate around large sprockets, each being motor driven through a speed reducer. By that

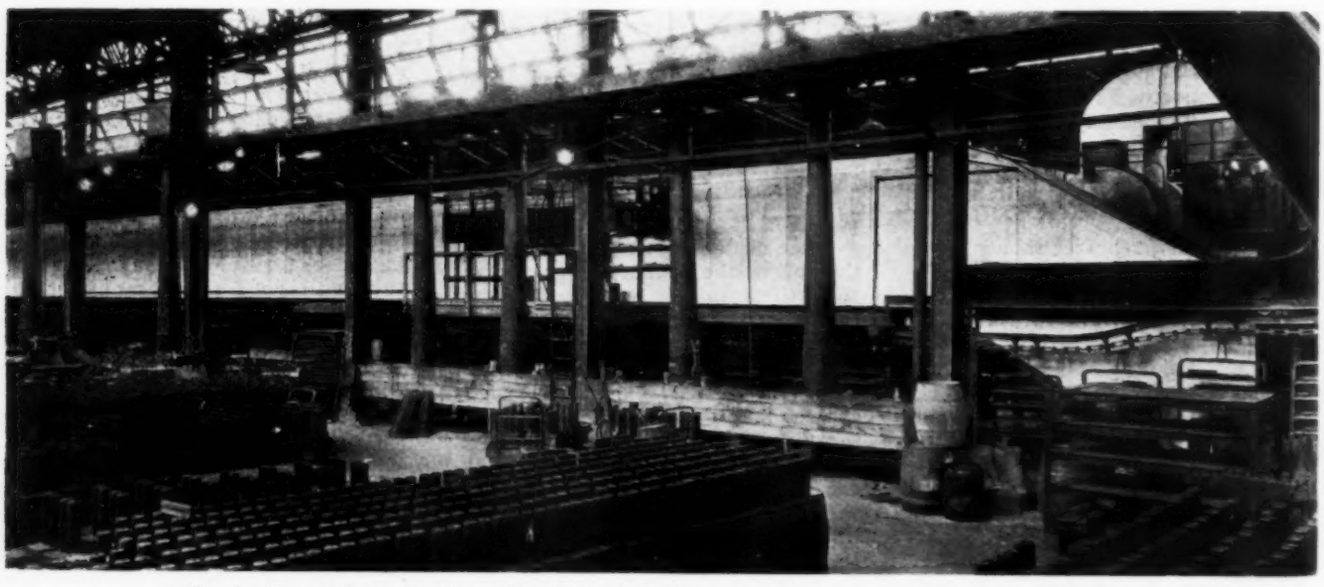


Fig. 1—Coremakers Benches Are Located Adjacent to the Oven to Reduce Core Handling

means any desired baking period may be obtained. Temperature control of each oven is maintained through two sets of thermocouples. One set is in the hot zone of the oven and the other in the delivery duct from the heating chamber. These are connected to motor operated valves which control the flow of gas and also to magnetic dampers which regulate the amount of cold air sucked into the mixing chamber.

Manufactured gas is used to bake the cores and is supplied to inspirator gas burners. The gas had a 530 B.tu. value and is supplied at 1½ to 3 pounds pressure. The hourly consumption of gas for this installation is approximately 10,000 cubic feet. Delivery is controlled by the temperature regulating apparatus. If electric current, compressed air or supply fans fail, the temperature controls automatically cut off the fuel supply to the burners.

With a maximum hot zone temperature of 400 to 500 degrees Fahr. the drying period is 3 hours. The capacity of the oven when operating both compartments, is 340 crank, case cores per hour. The total weight of material handled, inciuding racks, conveyor and cores is about 50,000 pounds per hour. Due to the use of such a large volume of heated air and the long travel of the cores previous to coming into the hottest zone, all of the free moisture is removed and the cores are dried uniformly and quickly. Cores come from the oven are light in color and there is a minimum amount of overbaked, shell baked or burned cores.

Gives Cycle of Operations

The black wash coat oven is located beneath the drying oven and is heated by hot air exhausted from the drying oven. That oven is built of insulated steel panels and is 24 feet long, 5 feet wide and 6 feet high. The dried cores are removed from the racks as they emerge from the drying oven, are dipped into the black wash and then deposited on one of two metal slat conveyors that run through the black wash oven. These conveyors are motor operated independently of each other and the speeds are variable, although the usual cycle is 12 minutes. A temperature of 350 degrees Fahr. is maintained by automatic temperature control which regulates the amount of hot air entering the oven.

Three vertical drying ovens also are located in the core room. The walls of those ovens are of the same construction as those previously described. However, the heating equipment consists of high pressure gas burners and inspirators. A method also is provided for cooling the cores prior to leaving the ovens. Two vertical type ovens are used for baking smaller cores and black wash drying respectively. They are practically identical in construction and each is 17 feet high, 6 feet deep and 5 feet wide.

Trays Are Suspended

Trays carrying the cores are suspended between two chain loops operating between two sets of 36-inch sprockets, one pair at the top of the oven and the other at the bottom. The trays are 8 x 36 inches. The sprockets are operated by a motor through a speed reducer which sets on top of the oven. Part of the oven is partitioned off from the rest by a vertical panel, with just enough room for the trays to pass through. Cold air is blown into this chamber to cool the cores as they descend. The drying period for the vertical black wash oven is 15 minutes.

Two high pressure gas burners fire into the combustion chamber, near the bottom, and products of combustion are exhausted through a stack at the top by a motor operated fan. Cores rise to the top of the oven and then descend into the previously described cooling space. The ventilating system is connected to this space as well as to the oven baking space proper and a single ventilating unit permits the removal of the moisture and fumes from the core baking space and also draws the fresh air for the cooling space. This ventilating system includes the necessary ducts and a motor operated fan located on the roof of the oven. For

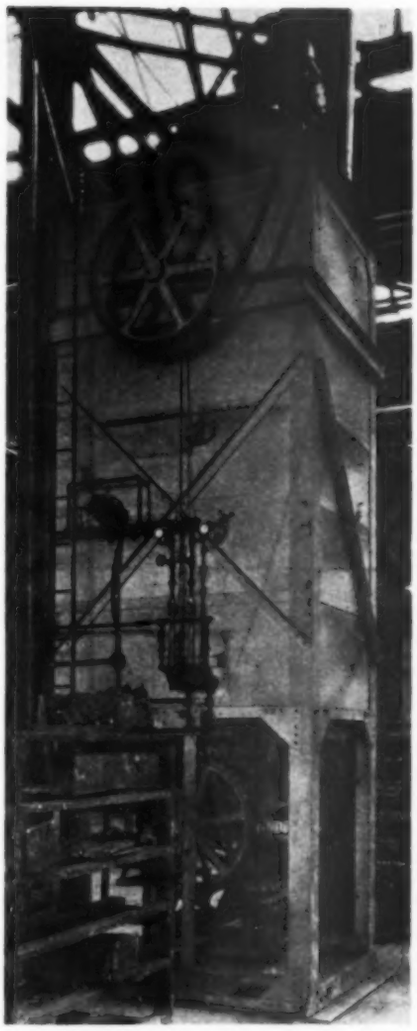


Fig. 4—Three, Vertical, Gas-fired Ovens Also Are Used

black wash a tmperature of 400 degrees Fahr. is maintained by automatic temperature control.

The third vertical oven is 30 feet in height and 7 feet square in cross section. In all essential particulars its construction and operation are identical with the two just described. One difference is that it requires three gas burners to heat it and a recording pyrometer automatically maintains a baking temperature of

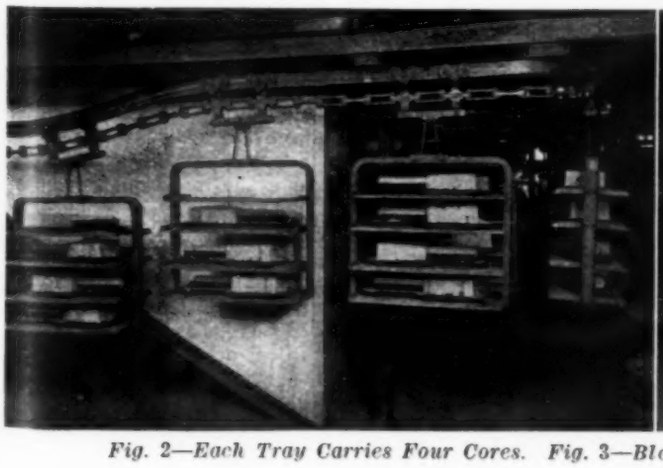


Fig. 2—Each Tray Carries Four Cores. Fig. 3—Black Wash Oven Is Located Below the Drying Oven

500 degrees Fahr. The recorders are connected to thermocouples and a motor operated valve in the gas supply line. Cores remain in the oven for 55 minutes. The oven contains 46 racks, carried by conveyor chains. Each rack has a capacity for 25 pounds of cores, 25 pounds of dryers and 40 pounds of core plates.

Overcome Alloy Ingot Trouble

By W. E. Paulson

THESE remarks are intended as a purely nontechnical discussion of the difficulties experienced by one foundry in producing nonferrous castings using alloy ingots. The author feels that this subject is a timely one, inasmuch as other foundries undoubtedly have had similar experiences with the use of alloy ingots. It is through the aggregate of experience and knowledge of course, that methods and products mutually are bettered.

The foundry of Thomas Paulson & Son Inc., Brooklyn, N. Y., has been producing high-grade products for over 40 years. Until a few years ago, the opinion was held that it was necessary to use virgin metal to procure the results the firm sought to accomplish.

However, a short while ago, price competition forced the firm to consider means for reducing costs, while still continuing to maintain the quality of product. Thus we turned to the use of alloy ingots, although it must be admitted that this policy was adopted with misgiving, having in mind the homely saying that "You can't make a silk purse out of a sow's ear."

Fault Not at Source

Ingots were procurred from a well-established concern of unquestionable reputation. It is only fair to state here that none of the author's comments are intended to reflect in any way upon this ingot producer's skill or integrity.

The first castings made from the ingots were, of course, examined with great interest. For one thing, in skimming the molten metal it was observed that more than the usual amount of dross was removed. Also, the castings, when taken from the mold and cleaned by the sandblast, exhibited a decidedly different color than was the case with castings poured from virgin metal mixtures.

In composition, the mixture consisted of copper 77, tin 8, and lead 15. An alloy consisting of copper 80, tin 10 and lead 10 behaved in the same manner.

After being reassured by the ingot producer that the conditions observed were not detrimental to the metal, the castings were shipped. As production continued, it was further observed that the surface discoloration was not consistent. That is to say, different heats exhibited marked differences in color, despite the fact that chemical analyses indicated close adherence to specifications.

After a number of lots of ingot metal castings had found their way into the machining departments of customers, it was not long before complaints began to come in with distressing frequency. The experiences reported by several shops were substantially identical.

No two lots of castings machined the same. All users were agreed that the machining time was increased. In too many instances, reports came in to the effect that numerous castings were unmachinable. Many castings, of course, were returned for credit, so that the anticipated foundry economies were wiped out and production costs increased.

At this stage, metal specifications were prepared excluding all impurities known to be detrimental. These impurities included iron, antimony, nickel and phosphorus. The ingot producers assured the foundry that, with rigid adherence to these specifications, the difficulties encountered would not recur. Feeling confident that this contention was correct, orders were filled using new ingot metal.

Hopes were somewhat shaken to find, first, that the surface color was little improved. Also, customers using the castings reported little improvement in machinability. Many machining operations at this stage of the work were observed and we were convinced that the claims made as to working difficulties were well founded.

It was then decided to call in a new source of ingot supply, and with this producer the previous troubles were discussed at great length. It is well known that those who are engaged in foundry work seldom succumb to discouragement, so with new ingot we again proceeded, with renewed hope. However, these hopes were quickly dashed, for the same troubles immediately asserted themselves. It is well to mentian that machining difficulties had manifested themselves in cutting tools being quickly dulled. Examination of the machined surfaces showed small spots that appeared hard. Many of these spots could be seen with the naked eye, while some could be detected with an ordinary magnifying glass and others were revealed only by the microscope.

Loses Customers

It now had become only too apparent that this condition had to be remedied immediately if customers were to be retained. Several, indeed, had already placed their business elsewhere.

At this time, Thomas Paulson & Son Inc. is using ingots in producing castings in the two alloys discussed in this article, and these castings are apparently the equal of virgin metal products. This result is being accomplished by the use of specially prepared metal.

No turnings enter into the composition, nor is any red-metal alloy scrap permitted. The mixture is prepared from clean copper scrap and solder metal, with necessary additions of tin and lead, and the whole bath of approximately 25,000 pounds is refined in a reverberatory furnace.

The conclusion that has been forced upon the author confirms his belief, held prior to the use of the alloy ingot, that virgin metals or their equivalent (the latter obtained by preparing ingot as described) are absolutely essential for production of best quality castings.

The subject of alloy ingot is one of great importance to the nonferrous foundryman, and doubtless there are many metallurgists capable of shedding light on the problems involved.

Use Special Ingot

USE of certain alloy ingots in a brass foundry gave castings which presented machining difficulties to the author. Adoption of specifications excluding iron, antimony, nickel and phosphorus from the ingot failed to improve conditions. The final solution was the use of specially prepared ingot from clean copper scrap and solder metal with necessary additions of tin and lead, as described in this article, which is abstracted from a paper presented at the Cleveland convention of the American Foundrymen's association. The author, who is president, Thomas Paulson & Son Inc., Brooklyn, N. Y., presents his experience to stimulate discussion, which may assist both foundrymen and metal producers.

Fundamentals of
FOUNDRY PRACTICE

Methods of Sweeping Gear Wheels of Various Types Are Discussed Exclusively in This Chapter

By Ivan Lamoureux

{Interpreted in the Light of American Practice by Pat Dwyer}

Part XVI

THE principal difference between the mold for a split pulley in which the arms are straight and one where the arms are crooked is that the splitting plane in the first is on a diametrical line, while in the second it is not on one line. The relative position of the bolting lugs on the rim and hub of a wheel with arms is shown in Fig. 189.

The molding of gears with cast teeth is not at present of as great moment as it used to be, owing to the continually growing use of cut gears. Cast gears are used in the manufacture of common winches and derricks, mills, crushers and other slow-speed machines. Herring-bone gears are used in the construction of rolling mill trains. That is why gear-molding machines, excellent in themselves, have not been installed to a greater extent in foundries. Outside of foundries making some particular specialty, rough gears are seldom cast in foundries. Many foundries cast gear blanks in which the teeth afterward are cut. The method described here gives excellent results without any special equipment provided of course that it is applied by careful molders.

To sweep a 32-inch diameter gear, make the joint according to the description of the fly wheel. Set a hub and six arm ribs, Figs. 192 and 193, in place in accordance with the divisions previously made on the circumference traced on the outside of the mold. At each point of intersection of the circumference and of the radii of division, put in a flat-head nail which will serve as a check-mark after drawing the pattern.

Before starting the sweeping of the drag, impress the hub pattern which has been increased to the thickness of the flat spokes. Whiten the top surface of the hub pattern with chalk and mark on it the prolongation of the radii representing the axes of the spokes.

Remove part of the sand from the tooth side, *c d*, Fig. 194, to extend joint *a b* also draw on the sand a prolongation of each radius. Hollow out with the trowel, the cavity required for impressing the vertical rib of the spoke, Fig. 195. Bring the axis of the pattern to coincide with the axes of the hub and of the rim. Ram up with sand to within 1-inch of the joint.

Impress the side pieces of the pattern, 1 and 2, Fig. 196, on each side of the vertical rib, 3, Fig. 196, to converge at the joint. Ram the sand and make a clean joint with the trowel after checking the height of the spoke pattern by a straight edge

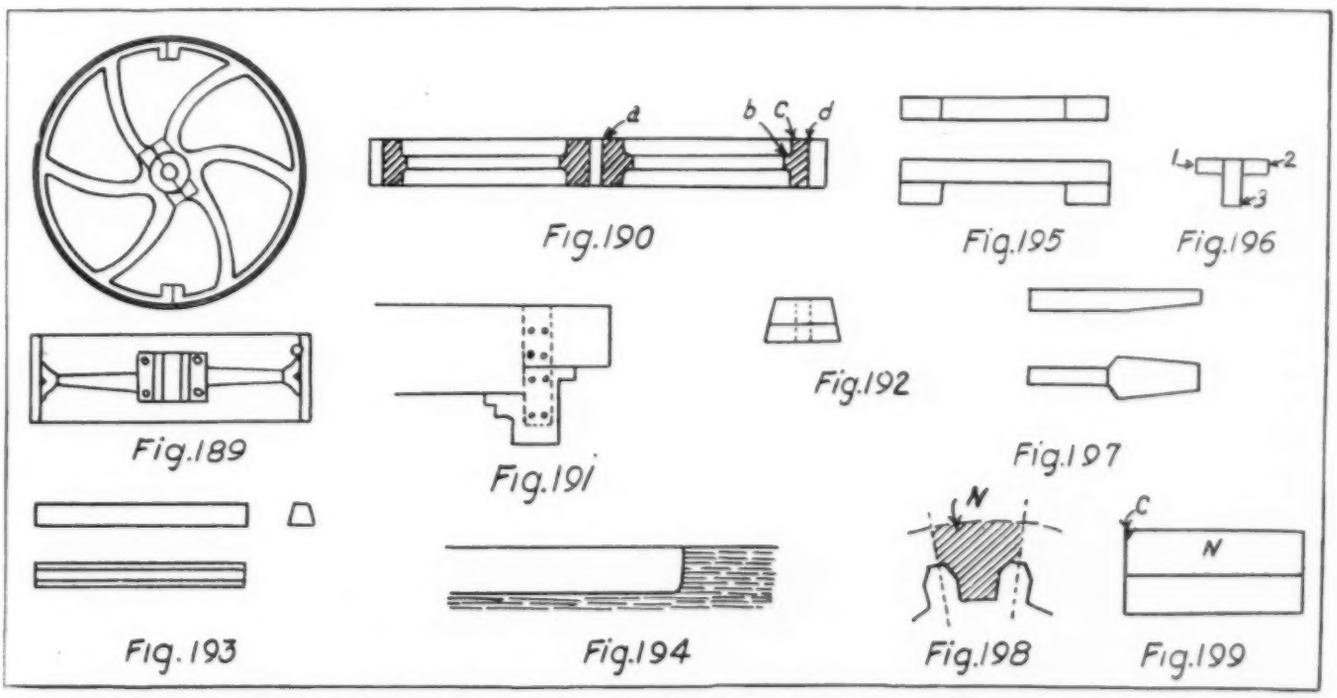


Fig. 189—*Method of Splitting a Crooked Arm Wheel.* *Figs.* 190, 191 *and* 192—*Gear Wheel, Sweep and Arm Pattern.* *Fig.* 193—*Pattern for Gear Arm.* *Fig.* 194—*Drag Prepared for the Teeth.* *Figs.* 195 *and* 196—*Devices for Forming the Arms.* *Fig.* 197—*Small Hand Rammer.* *Figs.* 198 *and* 199—*The Tooth Core*

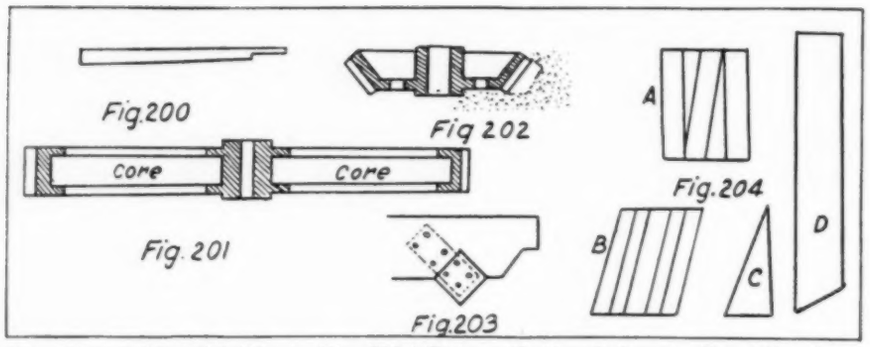


Fig. 200—A Straight Edge. Fig. 201—Gear with Cored Arms. Fig. 202—Bevel Gear. Fig. 203—Strike for Forming Bevel Wheel Joint. Fig. 204—A—Square Core, B—Core on Slant, C—Wood Wedge, D—The Sweep

resting at each side of the joint. Make the fillets in the same manner as those made for the spokes of elliptic section.

The bottom of a gear mold should be swept with the greatest care, especially the part which forms the core prints of the teeth. The rest of the mold is finished and blacked everywhere except at the core-print, to permit trying the cores later without causing them to stick.

The corebox forms a block of sand which fills the space between two teeth. It is composed of a strong bottom of hard wood, to which the tooth blocks are attached by bolts which pass through slots drilled in the bottom. A wood wedge helps to hold the various blocks together. With two or three convertible boxes of this kind, a great variety of gear teeth may be molded.

The molder rams the core with a dry sand mixture, a little at a time to obtain sharp corners and a hard core. Before opening the box and taking out the core, he cuts away a corner of the core, Fig. 199, to facilitate placing the core in the mold and to obtain a perfect fit in the core-print. The cores, with the exception of the first, or trial core, are dipped in blacking before they are placed in the mold.

Indexing the Teeth

To divide the circumference into as many equal parts as the wheel should have teeth, the molder takes a wooden circle the inside diameter of which is larger than the outside diameter of the mold. In the present instance this is 39 inches inside diameter and about 3 inches wide. The wood circle is placed concentric with the spindle and fastened to the sand by nails or small rods. The surface of the circle is chalked carefully and a pointed rod is attached to the sweep to act as a scriber. The circle or mark formed with the scriber 42 inches diameter, is divided according to the number of teeth. An approximation of the space between each pair of teeth is found by dividing the circumference of the circle by the number of teeth required.

For example, assuming that 50 divisions are required, the diameter 42 inches, is multiplied by the constant 3.1416. The result is 131.94 inches. Dividing this by 50, the quotient obtained is 2.63 inches which approximates the width of one division. A diametrical line is drawn with the aid of a notched straight edge and then the dividing of the circle is started by "trial and error." A pair of dividers is employed for the purpose. Sometimes a cast iron ring covered with white wash and then blackened with graphite is substituted for the wooden circle.

Radial lines are drawn at the intersection, marked on the circumference line by the dividers and each

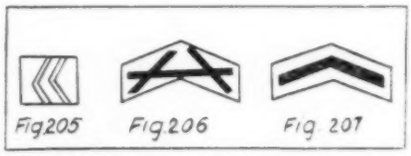


Fig. 205—The Core Block. Figs. 206 and 207—Method of Placing Rods in Teeth Core Blocks

of these lines serves as a quide for setting a sand tooth. The position of each tooth is verified by a straight edge with a notch in the center equal to one half the diameter of the spindle. The ends of the straight edge rest on the wood circle and the edge coincides with diametrically opposite marks. At the tooth circle the edge of the straight edge coincides either with the edge of the tooth block, or with a center line on top of the tooth. This sample tooth is fitted in place all the way around and any necessary adjustments then are made in the corebox. When the exact core has been secured, a full set is made and placed in the mold. The importance of a large outside circle becomes apparent in setting the teeth cores. The slightest difference on the tooth circle is magnified on the divided circle and thus insures a quite high degree of accuracy.

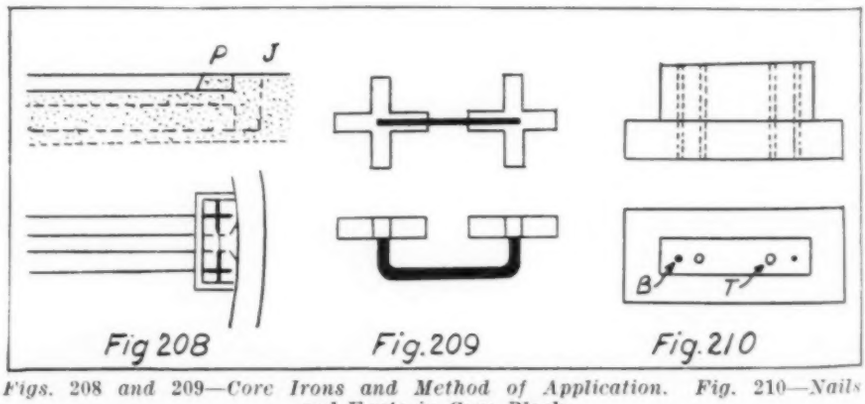
In another method the tooth block is fastened to the end of a suitable sweep and the tooth is rammed in place. The same precautions of laying out a working circle and checking the position of each tooth with a notched straight edge are observed. In a third method, several teeth are attached to a segment which in turn is fastened to a sweep arm. The sand teeth are rammed in place and then the entire pattern is drawn straight up and replaced a little farther around on the circle. The extreme left tooth on the segment is lowered into the impression left by the tooth on the extreme right of the same segment a few moments previously.

Formed in Dry Sand

Where the arms in a large gear wheel are I-section, the interior part of the mold is formed in dry sand cores as shown in Fig. 201. The mold is swept as if the piece were a cylindrical block. A cope impression first is swept on the floor. The cope is rammed on this and lifted away. Then the sand is dug out of the drag and the drag mold is swept to shape. The pie-shape cores for filling the center of the mold are made in a box, with a core arbor by which they may be handled. After they are dried, the cores are placed in the mold. Space between adjoining cores—for each arm—is determined by suitable gages.

As an alternative method, the arm cores may be formed directly in the drag instead of using a corebox. However, the process is much slower, the risk is greater and the total number of pattern pieces needed will cost more than a corebox.

Bevel gears are molded according to the same principles as the preceding, with a few slight exceptions. The sweep makes the necessary slope to bring the outside joint level with the top of the hub, Figs. 202 and 203.



Figs. 208 and 209—Core Irons and Method of Application. Fig. 210—Nails and Vents in Core Block

The ribs on the T-shaped arms will come with the cope and the flat portion of the arm will be imprinted according to the draft either in the cope or in the drag. Some of these wheels are plated in the center. In that case, cores are used to form any small openings required.

The molding of helicoid gears is the same as that of spur gears. If the inclination of the teeth is not to great, the cores will sit normally in the bottom of the mold.

If the inclination is great, a block of wood cut away on one side according to the inclination and perfectly square on the other is placed each time in front of the core to support it as in Fig. 204. The molding of herring-bone gears demands care of a particular kind and special skill on the part of the pattern-maker. The corebox for making the teeth is made in the usual manner and has in addition, two blocks, the one cut at an angle and the other cut to fit exactly into that angle. The first core is made without the blocks, Fig. 205, to give it a good bed which will hold the other cores. To give the cores the necessary strength, nails or cast iron gaggers are rammed in the form of the letter *K* for the small cores as shown in Fig. 206. When the width of the gear attains 8 inches, light cast iron V-shaped core irons are used. Those are shown in Fig. 207.

Use Lead Strips

The indexing is checked on setting each core. A trough has to be hollowed out on the outside through which the last two cores are introduced. This trench is then refilled. To obtain the part which in itself makes the teeth in the box, in heavy toothed gears of small diameter, a strip of lead is cast which is curved and attached with nails to the uneven surface of the blocks.

In molding straight cogged gears, that is gears in which teeth may be inserted, the number of teeth must be taken into consideration in making the division for the arms. The openings or slots required for placing the cogs pass clear through the rim. Therefore the arm must be attached to the rim between two of these openings, otherwise there would not be sufficient anchorage and it would be impossible to place the cog. Thus, for example, if there are six spokes and 58 teeth in the wheel the circle is divided into 58 divisions; four divisions with 10 teeth each and two with 9 each. If the spoke section is in the form of a cross, inlaid pieces *J*, Fig 208 are rammed up at the point where the spokes touch the rim before ramming up the cope. A flat joint thus is made inside and outside at the top of the rim. The joint should not be made at the level of the flat part of the spokes, where the cog cores would run the risk of being broken on closing the mold. Small core irons, Fig. 209, connected together with a bent steel rod are used to lift the small body of sand over the end of the end of each arm. The cog core is rammed the same as the core for the spur teeth. It is vented in two places and two nails are put in before drawing it out of the box. Position of the nails and vents is shown in Fig. 210.

A few cores are tried in the mold without blackening them. If the indexing is right, all the remaining cores are rammed and placed in the oven to dry. Drying the cores in place would not be practical, as the cores would run the risk of being broken during the assembling of the mold.

As a general rule, the indexing of the teeth of cog-wheels does not require any high degree of accuracy, as the machining of the cogs is done after they are inserted in place. Bevel cogged gears are molded in a similar manner.

Sweep Gear Wheels

THE sweep method and a consequent material reduction in pattern expense, is particularly applicable for the production of gear wheel castings of a size and shape where duplicates are the exception instead of the rule. Detailed description and illustrations are presented of the methods and equipment employed for molding spur, helecoid, herring-bone, and bevel wheels. Even where gear molding machines have been installed, a comparatively high degree of skill and intelligence is required on the part of the molders who operate them. The more or less temporary equipment described in the accompanying text is typical of that found in the ordinary jobbing shop where the molders have to rely principally on their own initiative and skill and where work is carried on with a minimum amount of pattern and other equipment.

British Institute Meets at Southampton

The meeting of the British Institute of Metals, to be held at Southampton from Sept. 9 to 12, promises to be exceptionally interesting. The proceedings will be opened on Sept. 9, when the ninth autumn lecture will be given by Prof. D. Hanson, vice president, on "The Use of Non-ferrous Metals in the Aeronautical Industry."

On Sept. 10, a civic welcome will be given to the members by Mayor Hector Young, in Chantry hall. Following this official opening of the conference, the members will discuss a number of metallurgical papers, several of which will be contributed by distinguished metallurgists from abroad. Meanwhile the ladies not attending the meeting will visit the Tudor House and the Old Town Walls.

Following a luncheon at the South Western Hotel, visits will be paid during the afternoon to Portsmouth Dockyard, by steamer; Romsey Abbey and Winchester, by motor-coach; the Supermarine Aviation Works at Hythe and Woolston, and the Ordnance Survey office. In the evening a reception and dance will be held in the Royal Pier pavilion. On Sept. 11 the members will resume the discussion of papers at 9 a.m., the ladies meanwhile proceeding on a motor-coach trip to Netley Abbey, and at 12:30 p.m. the business side of the conference will be formally concluded, when members and their ladies will be conveyed to R.M.S. MAURETANIA, where they will be entertained to luncheon on board by invitation of the Cunard Steamship Co. After luncheon there will take place a series of visits, including an inspection of the steamship and visits to the Floating Dock, International Cold Storage & Ice Co. Ltd., Harland & Wolff Ltd., John I. Thornycroft & Co. Ltd., the Ordnance Survey office, and Romsey Abbey and Winchester. In the evening a visit will be paid to the Empire Theatre.

On the concluding day of the meeting, Sept. 12, a choice of two all-day excursions is offered—a motor trip in the New Forest and a motor trip round the Isle of Wight.

Detroit Founders Hold Annual Outing

The annual outing and informal meeting of the Detroit Foundrymen's association was held July 24, at the Bald Mountain Golf club, Detroit, with over 100 members present. The program consisted of golf and a base ball game and tug-of-war between the foundrymen and supply and equipment men. C. H. Miller, Monarch Pattern Works, took the honors in golf and Frank H. Dodge, Werner G. Smith Co., was presented with a white pine mashie for high gross score. Supply men and foundrymen seemed to be evenly matched as the ball game ended with the score tied and neither could show an advantage in the tug-of-war. After all had worked up an appetite, dinner was served in the club house. Following the informal meeting, the evening was devoted to cards. The plans for the outing were in charge of the following entertainment committee: Charles D. Yahne, chairman; John A. Patterson, vice-chairman; Frank H. Dodge; and O. F. Carpenter.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions should be addressed to the Editor, The Foundry, Penton Building, Cleveland.

GRAY IRON

Will Resist Heat

QUESTION

We intend making some water cooled permanent molds for producing white iron castings. A large number of the white iron castings will have to be made, and consequently the wear and tear on the molds will be severe. We have heard that this type of mold is quite satisfactory if made of iron containing a certain amount of chromium. Have you any information on the amount of chromium to be used?

ANSWER

Chromium additions to cast iron which must resist heat are said to assist greatly in prolonging the life of the castings. The amount of chromium to be added will depend on whether or not you wish to machine the castings which in your case are molds, and the thickness of the castings. If the molds are to be machined, and they probably will be in some places, only a small amount of chromium may be added. This is due to the effect of the chromium which retains part of the carbon in the hard carbide form, and makes the iron unmachinable. Nickel sometimes is added with the chromium to modify the chromium effect.

A suggested composition for permanent molds without alloy additions calls for silicon from 2.0 to 2.25 per cent; phosphorus, under 0.30 per cent, and manganese, 0.60 to 0.90 per cent. With this as a base mixture, try adding ground ferrochromium in the ladle until you reach a point where the castings are unmachinable. Then reduce the amount of ferrochromium until the castings can be machined. We suggest that you begin with about 6 ounces per 100 pounds of metal which will give about 0.25 per cent chromium in the metal. Use of nickel in the ratio of two or three nickel to one chromium will modify the chromium effect and you will be able to add more chromium before the effect on machinability causes any difficulty. Nickel and chromium additions may be effected by using nickel-chromium bearing pig iron or by using a manufactured alloy containing these elements. Firms making the various alloying agents mentioned may be found in the advertising pages of THE FOUNDRY, and they will be glad to supply information which will assist you in solving your problem.

Q & A

Gives Grate Bar Mixture

QUESTION

We would like to know what cast-iron mixture is best for grate bars especially stokers and for burning buckwheat coal. Do you think that a low phosphorus, low sulphur and medium silicon mixture would do well? The section of such castings generally is light.

ANSWER

The opinion as to what is the best mixture for grate bars seems to vary to a large extent. Some foundries use the same iron that they pour into the regular run of castings, others use a large amount of steel in the mixture. Our suggestion would be to use as you mention, a medium silicon, low phosphorus, low sulphur mixture. White iron will resist heat better than gray iron, but it is rather brittle. By increasing the silicon content so that a mottled structure is obtained, you will have some of the qualities of both white and gray iron. If you wish to try alloy additions a suggested mixture includes 20 per cent of a natural nickel-chromium bearing pig iron. The silicon in the mixture is around 2 per cent.

Q & A

Stoveplates Crack

QUESTION

We are making stoveplates about two feet square which give us considerable trouble by cracking as soon as fire is put under them. We are using 60 per cent pig iron containing 3.50 per cent silicon; 0.30 per cent sulphur; 0.62 per cent phosphorus, and 0.92 per cent manganese; and 40 per cent machinery scrap. Can you suggest a mixture that will eliminate the cracking? Will 10 or 15 per cent steel scrap addition help matters, or the addition of nickel-chromium pig iron?

ANSWER

According to our computations your stoveplate should contain about 2.65 per cent silicon and 0.50 per cent manganese. This closely approximates the analysis generally used, and we cannot determine why you should have any great trouble from breakage. However, it may be that your cupola practice is not what it should be. There is a possibility that your bed is not large enough and the coke splits too small. This may cause what is known in foundry parlance as burned iron. Metal of this type will come hot from the cupola, but freezes quickly and does not seem to have any life. Another cause of your difficulty may be an internal strain due to the design of

the casting or the method of gating. See that you do not have any thick and thin sections adjoining without deep fillets to make the section change gradual. You might try annealing some of your castings at 1200 degrees Fahr. for one hour. Bring up to temperature slowly and cool in the same manner. A change in method of gating or breaking off the gates as soon as they set may eliminate internal strain.

We do not believe that steel scrap additions will help your case to any extent, but you might try them to see the results. Add the scrap on the last charge, and keep the castings poured with the special mixture separate from the rest of the heat. Addition of nickel-chromium pig iron is claimed to give heat resisting qualities to castings. Try 5 to 10 per cent addition in your mixture. Also communicate with the suppliers of this iron asking their advice.

GENERAL

Molds Piston Rings

QUESTION

Can you give information on how individual piston rings are made and the best mixture to use?

ANSWER

Individual or single piston rings generally are made from patterns mounted on plates with squeezer type molding machines to make the molds. The pattern plates and the flasks may be round or square. The number of patterns on a plate depends upon the size of the rings and in the smaller size rings may range from 5 to 12 to a plate. The patterns are arranged radially from a central sprue and instead of being circular are slightly oval in shape. This out-of-round shape is intentional, due to a piece of metal being inserted at the section where the gap will be machined later.

The length of the inserted piece will vary and depends upon the tension desired in the finished ring. The insert or gap section is placed at the point where the branch gate or runner from the sprue enters the ring cavity. A heavy piece of metal is joined to the pattern by a small, short gate diametrically opposite the in-gate and is outside the ring. This button as it is called acts as a small heating element and prevents chilling on the far side of the ring. The button varies in size, and in case of the average size automobile ring is about 1-inch long, ¼-inch wide and ½-inch high.

Molds are made for the multiple system of molding, with the molds placed one on top of the other, one sprue connecting the stacked molds. Piston ring molds usually are made 12 high. The bottom mold is blank due to the cavity being formed on the under side. In practice the first mold laid down has the sprue hole filled with sand so that no metal can enter. The top surface of the mold is flat and forms the drag of the first or next mold which has the cavity or the bottom. In molding, the flask is placed on the squeezer with a ring resting on top of the flask. The ring is about ½-inch high and of such diameter that it will rest on the flask without extending over the inside edge to any extent. Some sand is seived onto the face of the pattern and then the backing sand put in. The sand is tucked lightly around the inner edge of the flask. Then enough sand is put on the top so that it is level with the ring. The mold is struck off and the ring removed. The sand is squeezed and the mold removed. In tucking, only enough pressure should be used to prevent soft spots and drop-outs. Too much pressure will cause the sand to become too dense and cause chilled sections on the rings or actual gas blows.

Since the actual cost of metal in the rings almost is a negligible factor compared to the machining and finishing, it will pay to use the best materials in the metal charge. Therefore, we suggest that you use only pig iron and your own scrap. This will give you metal of a more uniform composition. Use small charges and melt your iron hot; a coke to iron ratio of 1 to 8 should be satisfactory. Select your pig iron so that the metal at the spout will have the following analysis: Silicon, 2.85 per cent; sulphur as low as possible; manganese, 0.60 to 0.70 per cent, and phosphorus, 0.50 per cent. Rings over 5 inches in diameter will need lower silicon, and in such cases reduce the silicon content to about 2.0 per cent.

Q & A

Sand Sticks to Bells

QUESTION

When our larger size water pipes are shaken out they are covered with sand from end to end. This coating of sand scrapes off easily and leaves a smooth, clean surface. How can be get these castings to come clean from the molds. On the bells of the 8-inch pipe the sand sticks so badly that we have to grind it off with an emery wheel. How can we prevent this condition?

ANSWER

Unless you are using two grades of sand and perhaps two grades of blacking we do not understand why the sand should scrape easily from a large pipe casting and at the same time stick to a light casting. The condition to which you refer may be due to any one of several causes, but probably is due to the fact that you are attempting to use sand from which all the bond has been burned through repeated use. Molding sand available in your district is exceptionally well fitted for making dry sand molds and so long as it is in fairly good condition will peel from the casting.

If you are using a synthetic sand, that is either old or new sand to which a binder has been added artificially, the fault may be due to the character of the materials, or, to the manner in which the sand is prepared for use. From the meager details submitted we believe that your sand has been allowed to deteriorate either through an attempt to get along without a proper amount of new sand, or, an attempt to use old sand artificially bonded without proper equipment or experienced supervision. The remedy in the first instance is to raise the amount of new sand above the usual quota. In the second instance a thoroughly experienced man should be placed in charge of the sand preparation until all the bugs have been ironed out.

Q & A

Improves Toughness

QUESTION

We are making light gray iron castings for hand lawn mowers and would like to know if we can improve the strength and toughness of our castings without sacrificing machinability or increasing our foundry loss due to cold shuts? We are using a mixture containing 37½ per cent pig iron and 62½ per cent No. 1 machinery and return scrap which gives the following analysis: Silicon, 2.50 per cent; phosphorus, 0.70 to 1.0 per cent; sulphur, under 0.110 per cent and manganese, 0.45 to 0.60 per cent. Some time ago we saw an article recommending 30 per cent pig iron; 55 per cent cast scrap and 15 per cent steel to produce an analysis as follows: Silicon, 1.75 per cent; phosphorus, 0.30 per cent; sulphur, 0.07 per cent, and manganese, 0.80 to 1.0 per cent. This mixture was advocated as giving a strong, hard iron, easy to machine and used for tire vulcanizers.

ANSWER

You probably can increase the strength and toughness of the castings you now produce, but it will require some experimenting on your part to correlate the resulting properties with desired machinability. At present your machine shop undoubtedly is used to machining soft gray iron, and when any attempt is made to produce a higher quality gray iron, comment will be made in no uncertain terms from this department. However, if you see that machining speed is correct and the machines are tooled properly, you should have no difficulty in machining the best grade of gray iron. We believe that the silicon content now used is about right. The phosphorus is too high for castings that must withstand impact. This element should be reduced to about 0.30 per cent. When reducing the phosphorus, remember that the iron will have to be poured HOT. Manganese is a

little low, and should be increased to 0.60 to 0.70 per cent. The mixture given for the vulcanizers will give a dense, strong iron, but the silicon is too low for your purpose, we believe. You could try the same ratios of components with the exception of seeing that the silicon is around 2.50 per cent. If this iron is still soft reduce the silicon content gradually until you get the desired results.

Q & A

Plates Do Not Stick

QUESTION

Our regular practice in molding vises is to grind and tin the steel plate insert before placing it in the mold. We also have tried coating the plate with copper and with borax. Some of our experiments seem to indicate that an uncoated plate knits more firmly to the iron than a coated steel plate, but the subsequent machining operation disclose a number of blowholes on the cope side of the casting. Do you know of any better method for preparing and using these steel inserts so that our difficulties may be eliminated?

ANSWER

The method you have outlined is practiced universally in foundries where these vise castings are made. The only feature you omitted to mention is the practice of gating the mold so that the metal flows in a constant stream over the plate while the mold is filling. Also a small amount of iron is *flowed* through the riser.

Flowing the metal has a tendency to keep the metal in the mold fluid until any commotion from the plate has subsided. The basic principle involved is that the face of the steel plate must be raised to the fusion point before the adjoining molten iron commences to cool. That is the reason the iron in the mold is kept in motion. If the first iron that comes in contact with the plate is allowed to remain there, it will form a skin that effectually prevents a later intimate union even though the plate is raised to the point where it could fuse with the incoming metal.

Q & A

Permanent Molds Crack

QUESTION

We are making permanent molds for brass and bronze castings, and our customer claims that the molds are not standing up the way they should. These molds are made in three parts with a metal section from 2 to 2½ inches. They only are machined on the joints. The molds are made in dry sand and the iron used contains 30 per cent steel scrap. The analysis is silicon, 1.50 per cent; phosphorus, 0.25 per cent and manganese, 0.70 per cent. After using the molds a few times they show firecracks and blister on the face. The smaller molds seem to work all right. Can you give me any information on this matter and any data on the possible life of one of these molds?

ANSWER

It appears to us that your difficulty may be due to two things. Either the wall thickness of the molds is not enough to prevent them from reaching high temperatures, or your metal is such that it is easily affected by heat. Since you cannot change the wall thickness of the castings without your customer's permission, it will be necessary to experiment with the metal to obtain the desired qualities.

Several methods are available to you. You might try reducing the silicon content until you reach a point where it is difficult to machine the castings, then increase the silicon slightly to avoid that difficulty. Another method would be to add chromium or chromium and nickel to your present mixture.

Chromium may be added to the ladle in the form of 70 per cent ferrochromium. Chromium and nickel may be added as a manufactured alloy of nickel and chromium to the ladle or as a nickel-chromium bearing pig iron to the mixture.

You may be interested in two articles that have been published in THE FOUNDRY relating to permanent molds for brass and bronze. These articles appeared in the Aug. 15, 1929 and Jan. 1, 1930 issues. The author states that some of the molds have produced from 1000 to 3000 castings without showing firecracks, or other faults.

Q & A

Castings Show Shrinkage

QUESTION

We are experiencing difficulty in securing a solid 12-inch ball made from cupola melted hard white iron. We have placed chillers in the mold and have churned the casting through a riser, but still the casting shows a shrunken area.

ANSWER

The methods you have tried to secure a solid casting are those usually employed. A chiller on the inside helps to equallize the cooling speed of the mass of iron and prevents a *pull* at the last minute. The riser on top admits fresh, hot metal so long as it remains open. A possibility exists that your riser was too small and that it closed at the neck before the metal in the mold solidified.

Try using a larger riser, at least 4 inches in diameter at the point where it joins the casting and expanding to 6 inches for the remainder of the distance. Keep this riser open with a rod and with hot metal until the casting solidifies. The riser may be necked about ¾-inch from the bottom and in that way it can be broken clean from the casting with a sledge. A certain amount of grinding will have to be done to secure a spherical contour on the casting.

The foregoing method will produce a solid ball, but other methods are available that can be applied with a great deal less trouble and which produce balls good enough for all practical purposes. In former times when cast iron cannon balls were made extensively in the foundry, the practice was to pour the casting through a small pop gate on top.

Guided by his experience the molder waited until a crust of metal had formed on the bottom of the casting. Then he turned the mold over. These castings were more or less hollow in the center, but that did not affect their usefulness. If absolute uniformity of structure is not a requisite, the mold may be almost filled with pieces of clean scrap or with specially prepared fillers. For example a 6-inch or an 8-inch ball placed in a 12-inch mold would leave space for only 3 or 2 inches of new metal all around it. If you have orders for these castings in considerable quantity, it may be worth your while to make several heavy cast iron molds. If the metal is poured into these molds slowly it will result in solid castings.

Q & A

Process Is Expensive

QUESTION

We are smelters and refiners of metals and in connection with our business we handle a great quantity of miscellaneous steel scrap. We have a large unused cupola on the premises and we are contemplating the manufacture of synthetic pig iron from our available scrap with the addition of the necessary ferrosilicon and ferromanganese. Do you think we can do this and sell the pig iron at a profit?

ANSWER

No! Satisfactory iron can be made in the manner you outline, but unfortunately it cannot be produced at a figure that will enable you to compete with regular pig iron in the open market. The experiment of making synthetic iron has been tried many times under press of special conditions, but immediately these conditions were removed the practice ceased. Without attempting to go into intimate detail the following approximate figures will show you the futility of the attempt. At present market quotations in your district pig iron is selling for $19.00 per ton. Steel scrap is quoted at $12.00, ferromanganese $99.00, ferrosilicon $88.50, coke $6.00. To convert the steel scrap into pig iron you will require per ton: 1¼ tons steel scrap at $15.00, 40 pounds ferromanganese at $1.98, 60 pounds ferrosilicon at $2.65. In metal alone the cost will be $19.63 and this takes no account of coke, limestone, repairs, labor, handling and selling expense.

Problems in Nonferrous Founding

By Charles Vickers

Bronze Skulls in Ladle

We have some aluminum bronze scrap and also turnings to melt, containing approximately 90 per cent copper and 10 per cent aluminum. We are wondering which is the best way in which to accomplish this, our furnaces being of the open flame type, fired with oil or gas. Our experience in handling this metal is limited, but we understand that it is a difficult proposition. In melting turnings we have been told that oxide of iron assists matters materially, but we would like to know if it will have any detrimental effect on the metal. If not, could it be used in melting such scrap as truck gears of the Ford type?

There is no reason for assuming that aluminum bronze is a difficult alloy to remelt. In fact the metal is improved greatly by a remelt. Usually it is necessary to ingot the new heat and then remelt the ingots to make the castings, when the highest qualities of the alloys are to be realized.

If the metal is remelted several times it may lose aluminum through oxidation. To maintain the high standard of the alloy it is necessary to replace this lost aluminum after a few heats. We have no figures on what this loss will amount to, as we are unaware of this ever having been determined in a scientific manner. The loss may be small, but after the bronze has reached the scrap stage and is remelted, the addition of 0.25 per cent aluminum to the melt can only do good, to a 10 per cent bronze, for, the 10.5 per cent bronze is greatly superior to the 10 per cent bronze. The firing pins of the old Springfield rifle were made of the 10.5 per cent aluminum bronze, which was claimed to be superior to steel, and also to the 10 per cent bronze, which failed when tried for this work. It is well to keep the re-run scrap up to 10 per cent aluminum.

The most annoying difficulty in remelting aluminum bronze is the tendency it has to form skulls in the ladle or cruicible. In a new crucible a skull is left behind which when cold, because of the smooth walls of the crucible, can be pulled out. When the pot is old and rough the skull cannot be detached. At every melt it gets thicker, and next to the pot the skull will oxidize to a nonmetallic substance, which also accumulates. In an open flame furnace this material clings and cannot be removed without damage to the lining. Therefore, a naked brick lining should never be used because the bronze will seep into every little crevice. The best way to overcome this is to coat the brick with an inert material like alundum cement. All that is wanted is a nice and smooth lining, from which the skull can be detached and the lining smoothed up again. Never permit this skull to build, and always start out with a clean, smooth lining. Lime washing will not do, for both lime and fluorspar must be kept away from aluminum bronze.

The use of iron oxide is not advised. If iron is to be added, use tin plate. It is added best at the time the bronze is made and largely before the aluminum addition. Iron oxide, of course will reduce the aluminum content if the bronze is heated enough, and will produce an aluminothermic reaction harmful to the bronze. A little manganese chloride sometimes is helpful when used about the same as zinc chloride is used on aluminum. It will separate the metal from the dross, and at the same time is not harmful. While scrap bronze gears are easy to melt, watch out for the formation of skulls.

Q & A

Cores Stick in Casting

We are having trouble with our cores for brass castings. They are round stock cores from 1-inch diameter upwards used in bushings. The smaller sizes cause more trouble than the larger ones. We use a white silica sand bonded with oil in the ratio of 30 to 1, but the cores burn in so strongly that at times we can only remove them with great difficulty.

A ratio of only 30 sand to 1 oil is rather low and we should think the cores would be too hard. However the proportions depend upon the kind of oil being used. If the cores do not blow the mixture may be all right.

White silica sand is excellent for the purpose, but it is necessary to coat the core suface with something that will fill up the spaces between the grains of sand and thus make it impossible for the metal to penetrate into the core structure. Plumbago is generally used for the purpose and it is effective when properly used. It is necessary to put on more than one coating. The first coating should be put on the green core. The best way to do it, is to use a power sprayer which drives the wash into the spaces between the grains of sand. After the cores are dried, use the plumbago thick enough so that it can be smeared on the core. Rub it in well and then polish the core. Mix the plumbago with molasses water. Merely painting on the plumbago will not prevent penetration by the metal.

Q & A

Gives Melting Data

We are in the iron foundry business and are contemplating the installation of a small brass foundry unit to make small brass castings such as are used on gasoline stoves. These castings weigh about 4 ounces each and have cores in them. It is necessary for the castings to be sound and free from porosity to hold the gasoline without leaking. Also the cored holes must be smooth. If they come rough, this defect causes a whistle in the stove when it is used, which is objectionable. We will appreciate information regarding the mixture to use, at what temperature it should be poured, and the sort of molding and core sands to use. As we are inexperienced in brasswork, we would like to avoid trouble at the start.

For melting the brass use either a gas or an oil-fired furnace adapted for a No. 35 or 40 crucible holding 100 or 120 pounds of metal when it is molten. This is a convenient size for pouring small castings when the output is limited. However, should there be enough of this work to keep one or more molders going all the time, the furnace should be large enough to accommodate a No. 70 crucible which will hold around 200 pounds of brass when new. Starting with a cold furnace a heat of this size will require about one hour's heating before it is ready to pour, and with a hot furnace, about half that time. In such a case place a half cupful of borax in the bottom of the pot when charging and noth-

ing else except the metal. Bring the heat up to 2300 degrees Fahr., by pyrometer and pour at 2250 degrees. When the pot is ready to pour, lift from the furnace, skim off the dross etc., and add one ounce of phosphor-copper for each 100 pounds of metal. Get the metal to the molds quickly and pour rapidly.

For the molding sand use a grade corresponding to Albany 00, and for making the cores use a white, fine silica sand, bonded about 1 to 60 with linseed oil. The cores should be baked. The things to avoid are clumsy equipment. If snap or taper flasks are preferred, do not use old and worn out flasks and jackets. It is advisable to get new and properly fitted flasks and jackets. Instead of making your own mixtures of copper, zinc, tin and lead, it will be advisable to buy ingot brass, using ounce metal or 85-5-5-5, which is a standard alloy. This ingot must be *absolutely* free from aluminum, otherwise the castings will leak and castings loss will be high.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of The Foundry or of its editors.

To the Editors:

For several years I have heard a great deal regarding the attitude of industry and business in favor of the man with a technical education. It is a fact that many companies have an absolute deadline against men with a non-technical training. Every year there is a large and steady increase in the number of technical men turned out by the colleges. Most of the universities and technical schools have turned out during the past 4 years from 20 to 30 per cent more technicians than can be used in industry. Some of these poor fellows are due for a rude awakening because business has not expanded enough during the past decade to take care of them. Most of the important industries in this country easily can produce 30 to 50 per cent more goods than they can sell.

Another problem of grave importance also faces the technical graduates: The manner in which they have been, and are being exploited. Production methods at present are so standardized that technical graduates all over the country find themselves competing in the same market with common labor to gain an entrance to many of our industrial plants. Wages of the common laborers also are kept at a low level by the number of technical men employed in many plants. Many graduates of several large schools complain of this condition. Several schools refused admittance to many captains of industry who came to the schools to interview students with outstanding qualities.

At one large plant I had 12 young fellows as special apprentices. To get that kind of a job they had to be graduates from accredited schools with letters M. E., after their names. Several of them did well, especially those who outgrew their college education rapidly. Frankly speaking, some of them did not amount to much. If a technical education is all that it is represented to be and if God spares me, I should be running a foundry when some of the technical guys I have met are making left hand turns in wheel chairs.

A Practical Foundryman.

Must Cool Uniformly

To the Editors:

For 42 years I have been trying to make straight castings. Ten as molder, the rest as a foreman, superintendent, general superintendent, etc. Practically all of this time has been spent in making architectural castings such as cornice, facias, ornamental columns, greenhouse gutters and sills, pipe and boiler castings, etc., etc.

A great deal of this time has been spent in teaching foremen and molders how to strip a casting so as to get it straight and in having the architect and pattern maker construct patterns with uniform thickness so as to get a uniform shrinkage.

Now in the Aug. issue of The Foundry, page 92 you claim I am merely a theorist! In the third paragraph you state cooling metal contracts *but*. There is no but.

It *will* contract, and if you try to hold it, it will pull apart. There is no power on earth which can hold a casting from contracting; although sometimes the metal is elastic enough to prevent its pulling apart up to a certain limit.

Next paragraph, I do *not* believe that the ends rise in the early stage but that the thin sides cool off first, taking the heavier or semi-liquid part along with it. In other words, crushing it together, without bending or distorting it. Now comes the final part, the heavier parts will shrink or contract more than the thin part from this point. The result will be a crooked casting with the heavy side concave and the light side convex.

There is absolutely no question about this. It is a physical impossibility to make a pipe, a column, lamp post etc., straight, when there is an unequal amount of metal on the two sides or top and bottom, unless the heavier parts are stripped and exposed to the atmosphere, so that all parts of the casting will cool off at the same rate. No matter how rigid the top becomes, the irresistible force of the bottom or heavier part will draw it down.

As to the plate, surely there is no difference of temperature in the top and bottom of a plate 1/8-inch thick. Such a plate can be dished either way same as we can push the bottom of a dishpan either in or out.

Plates become crooked because the heat radiates from the outer edges fastest. Outer edges being cooled when the center cools draws up the four corners. To overcome this we strip the plate across the corners, or place a heavy runner around, and close to the casting to retain the heat at the edges.

We make cast iron pipe 9 feet long, 4 inches in diameter and 5/16-inch thick. These pipes are much the same dimensions as the lamp post in question.

Our method of straightening these pipes is interesting. We heat several spots to a cherry red with an acetylene torch on the *long, thin* side. This makes the casting still more crooked; but if the heating has been done properly the pipe will draw back straight. "Believe it or not." If the top side of a pipe or lamp post cools first or if the top is lighter than the bottom the ends will be down.

Walter H. Hofman

Elizabeth, N. J.

Celebrates Occasion of Golden Anniversary

The anniversary of fifty years of business activity was celebrated by Henry Vogt Machine Co., Louisville, Ky., on July 3. A party was held in the new, 9-story, warehouse of the company by the employes and friends of the president, Henry Vogt. Mr. Vogt presented each of the 945 employes of the company with an eight-day clock in honor of the occasion and they in turn expressed congratulations by presenting Mr. Vogt with a suite of office furniture.

A. H. Sanford has been appointed branch manager of the Wilmington, Del., district, naval stores division, Hercules Powder Co., Wilmington, Del. George C. O'Brien, formerly branch manager in the Wilmington district, has been named manager of the Chicago office of the division.

The FOUNDRY Family Photograph Album

Upper Left

HOWARD COONLEY

Walworth Co., Boston

Upper Right

R. O. MONROE

Smith-Monroe Co., South Bend, Ind.

Lower Left

W. F. ROGERS

Crown Stove Works, Chicago

Lower Right

S. CARROLL

Pacific Car & Foundry Co., Seattle

PROPOSED TENTATIVE SPECIFICATIONS FOR

Austenitic Manganese Steel Castings

(*Continued from Data Sheet No.* 824)

150 degrees. The bending may be by any method preferred by the manufacturer.

8. In the case of castings weighing not over 50 pounds and if satisfactory to the manufacturer and inspector, a test to destruction may be made as an alternative to bend tests when the latter are specified. For this test the castings shall be grouped in lots, each lot containing castings from the same melt and from the same heat treatment charge. From each such lot the inspector shall select one casting to represent the lot. The representative casting shall be tested to destruction by pressure or by blows. This test shall show the material to be tough and ductile, and suitable for the purpose intended. The cost of all such test castings shall be provided for in the purchase order.

9. (*a*) Bend test specimens, when specified, shall not be cast attached to the castings, but shall be poured in separate molds, from the same heat or melt of steel as the castings they represent. They shall be ½ x ¾-inch in cross-section and 12 inches in length, and shall be heat treated and tested without being machined or ground except when necessary to remove irregularities of surface, or to separate them from the runner or sprue through which they are poured.

(*b*) Bend test specimens, when specified, shall be heat treated with the castings they represent. When bend test specimens are heat treated with castings of comparatively heavy section, the test bars should be protected from oxidation by enclosing them in pipes or containers containing a small amount of carbonaceous material, and suitably sealed or luted to prevent the furnace gases from coming in contact with the test bars. To permit the expansion of the gases within these containers, they should not be sealed completely.

10. (*a*) When bend tests are specified, one such test shall be made from each melt or heat of steel in each heat treatment charge. When so specified by the purchaser, one bend test shall be made from the steel used for pouring each casting weighing 500 pounds or over.

(*b*) If any test specimen develops flaws and does not conform to the requirements specified, it shall be discarded, in which case another specimen from the same lot shall be substituted.

11. If the results of the bend tests for any lot do not conform to the requirements specified, such lot may be reheat treated, but not more than twice. Retests shall be made as specified in Section 7 (*b*). In the case of reheat treatment and retest, when bend tests are specified in the order, two

(*Concluded on Data Sheet No.* 826)

PROPOSED TENTATIVE SPECIFICATIONS FOR

Austenitic Manganese Steel Castings

(*Concluded from Data Sheet No.* 825)

bend tests from a lot, or from each casting weighing 500 pounds or over, instead of one as specified in Section 10 (*a*), shall be required, both of which shall conform to the requirements specified in Section 7 (*b*).

Workmanship and Finish

12. The castings shall conform to the shapes and sizes indicated by the patterns and drawings submitted by the purchaser, with such tolerances as are customarily allowed, in the case of parts not finished to exact dimensions by grinding or machining.

13. (*a*) The castings shall be free from injurious defects.

(*b*) Defects which do not impair the strength of the castings may be welded by an approved process. The defects shall be cleaned out to solid metal, before welding, and when so required by the inspector, shall be submitted to him in this condition for his approval. No welding shall be done except such as is approved by the inspector.

Inspection and Rejection

14. (*a*) The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the castings ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications.

(*b*) All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment unless otherwise specified in the purchase order, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

15. (*a*) Unless otherwise specified, any rejection based on chemical analysis made in accordance with Section 6 shall be reported within five working days from the receipt of samples.

(*b*) Castings which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected and the manufacturer shall be notified.

16. Samples tested in accordance with Section 6, which represent rejected castings, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

THE FOUNDRY DATA SHEET, AUG. 15, 1930
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Control System

Is Applied Easily to Foundries

By Clifford E. Lynn

A PRODUCTION control or planning-dispatch system if efficiently organized and managed by competent employes who have had practical foundry experience, will relieve the foreman of the great burden of ordering stock, laying out work for the men and chasing stock and orders throughout the shop. He can concentrate on production.

Especially is this true in a foundry operating on a production basis where the men are paid piece work rates and bonus. In the event a day or hourly rate of pay is to be abolished, and a piece work rate established, time studies of each operation for coremaking, machine or bench molding will have to be made with a stop watch. From 10 to 25 studies will be required and then a total time study.

Obtain Representative Time

These studies should be taken at different times and under different conditions to enable the time study man to get a wider scope. An average then should be determined allowing for fatigue, waiting on stock or other causes beyond the operator's control. A study should be made of unit costs under the old day work system to show whether any given rate would be adequate, too high or too low.

Of course it is necessary for the foremen and workers to cooperate with the time study man or rate setter. This cooperation can be secured from the workers by explaining that it is to their interest to do more work and receive more pay per day. They would have to spend the same amount of time in the plant under any conditions.

After an adequate and fair rate is established, it should not be changed unless absolutely necessary. A reduction often creates trouble among the employes and the whole system breaks down before it is given a fair trial.

Any fair minded employer will realize that his payroll will increase with increased efforts and production, but increased production with efficent inspection methods to establish a high quality means lowered costs in the end.

The first thing necessary in establishing production control from the foundry office is to secure some one with clerical ability who has a good working knowledge of foundry routine, production, stock and orders. He should start by using a card showing number, or name of employee, pattern number order number, drawing number, operation to be performed, time limit set for this operation, amount produced, rejected castings, and space left for remarks.

All sand, flasks, cores, etc., should be ordered in advance to be on hand when wanted In the beginning a lay out is made of the molding floor, keeping in mind the orders for preference, those partly finished, and new ones coming in.

Time Is Recorded

The men responsible for this work then will secure the patterns from the pattern shop or storage and place them in a pattern room with a boy or elderly man as clerk. A number is placed on each pattern. As the molder finishes each job, he calls at the office where this card shows what pattern and order he is to work on next. He then goes to the pattern room, selects the pattern called for and records time started on the card with a time recording device.

When he completes the job he punches or records the time. The production clerk should have another card in the rack, so that the employee immediately can secure his pattern and get ready for another job. The same man should be employed as far as possible on the order or job he started. The foreman indicates to the clerk, the molders better suited for any particular kind of work. His cooperation at the start must be obtained by the clerk in laying out the work to prevent friction. After the clerk has secured sufficient experience he will be able to proceed without assistance.

In a steel foundry, a tin or metal tag should be placed on the flask before the heat is poured. A clerk will go over the floor, counting the good castings, noting the bad or broken ones and crediting the molder whose tag appears on the flask.

The tag with another card containing a record of the castings should accompany them to the sandblast so that the castings will not become separated before a proper production record is made of castings sandblasted and inspected.

Have Complete Record

The clerk who records production from the metal tags also can post it on molder's time card showing date cast, sandblasting time from sandblast foreman's report, with rejections made by inspector, etc.

Thus a complete record of each molder's production is made and sent to the time department where it is checked with clock card, if a clock card is used for that purpose. The time clerk enters rates, computes pay,

Daily Sand Blast Production & Inspection Report

Date _____

PATTERN NO. DWG. NO.	KIND OF CASTING	NO. SAND B.	NO. INSP.	NO. REJ.	NO. GOOD CASTINGS	DISPOSITION

Remarks _____

Signed _____

Fig. 1—Production Record of Castings Cleaned and Inspected

W. H. Jones Co., Pittsburgh, Pa.

No. 531 Fdy. Time & Prod. Card

Order No. _____

Drawing No. _____

Pattern No. _____

	Time A.M. P.M.	Operation	Amt. Pro.	Rate	Cost
Started					
Finished					
Elapsed					
Started					
Finished					
Elapsed					
Started					
Finished					
Elapsed					

Stock Required _____

_____

Remarks _____

Rejected Castings _____

Disposition

Fig. 2—Detailed Time and Production Card Record

W.H. Jones Co.
Pittsburgh, Pa.

Daily Production Report Date _____

Foundry Production						Sand Blast				Inspection			Amt.	Rate	Cost
Check No.	Order No.	Dwg. No. Pattern No.	Kind of Operation	Amt. Prod.	Stock Used	Check No.	Pat. No.	Kind	Amt.	Rej.	Good	Disp.			

Remarks _____ Signed _____

Fig. 3—Card Supplies Data for Progress of Orders, Inventory and Pay Roll

and turns the card over to the cost department which will distribute and post costs of each order. From these cards a daily production record of each order can be made and copies submitted to all concerned.

Where castings enter the machine shop for drilling, facing, machining, etc., the same system can be followed out. A lay out, or planning-despatch man receives a copy of the foundry production report, checks up on castings coming through, chases any he may require from the foundry, makes a report of those received dates, etc., and lays out the work for the machinists or operators by cards showing all required production information.

Another clergk can record the castings received, issue drawings and tags to the operator, showing all information for operator to place on castings, after he has machined them and sent them to the inspector's bench.

As the inspector clears the order, he notes rejections for each man's work also the number of pieces to be credited. This information he posts on the time cards. The stock chaser or trucker takes the machined castings from the machine shop, and lifts the inspector's tag which he turns into the office and from which the clerk finishes his production record of the machine shop showing castings arrived, castings machined, castings held in shop for machining, and those taken out to assembly room or elsewhere.

The time and cost department will be in a position to distribute costs, make up payrolls etc., from these records. The foreman will be able to devote his entire time and attention to production problems.

In no case should there be over two clerks in any small or average sized foundry or machine shop for one shift of employees. In large production foundries and machine shops, a clerk to record time and production on the employees time cards, one to record stock entering and leaving the shop and to make out a daily machine shop or foundry production report, a planning-dispatch man to lay out the work from dispatch board, and possibly a stock chaser, may be required.

Pipe Requires Rigid Inspection

By F. M. Randlett

USE of cast iron pipe for the transportation of water, particularly in the distribution systems of the modern water works plant, has grown to enormous proportions. The engineer or manager of any utility plant or corporation providing constant service to its consumers is aware that breaks, failures, or interruptions of service are expensive. They also often are dangerous to life and health and result in loss of business. Therefore, it is the duty and desire of every official or owner to exhaust every reasonable effort to procure the best materials and workmanship in the construction of a distribution system and supply lines and thereby eliminate trouble and expense that otherwise may be frequent.

The average water works system is more or less a development from a small beginning. The original system may have been designed and built of materials where the first cost was the controlling factor, without much consideration being given to future development and economies.

In adding to or enlarging any system, the first step is the design of the works. This includes the determination of size and quantities of the materials required for the present and immediate future. The second step is the preparation of proper plans and specifications covering the materials to be used and the quality of workmanship. It is in the preparation of these specifications that care should be taken to make such specifications and plans as complete and definite as possible.

Standard specifications for the manufacture of cast iron pipe have been published in various forms and by several well-known and reliable organizations. For instances there are the standard specifications for cast iron pipe adopted by the American Water Works association, May 12, 1908 and the American Society for Testing Materials' specification A-44-05. In addition several specifications have been prepared by manufacturers, covering special processes for the making of cast iron pipe, not as yet included in the standards previously mentioned. All of these specifications call for certain qualities, dimensions, methods of manufacture and set forth certain requirements as to maximum and minimum tolerances of dimensions, tests and chemical composition. Considerable time, thought and expense have and still are being spent on standard specifications by various bodies.

Outlines Duties

QUALITY and workmanship in cast iron water pipe must be of high standard to safeguard the health of communities throughout the country that require daily service from utility companies. In this article, which was abstracted from a paper presented at a recent meeting of the Montana section of the American Water Works association. the author outlines the duties of the independent inspector to his employer. He also gives some pointers on the wording of contracts and their interpretation. The author is a former trustee of the American Water Works association and for 19 years was assistant and chief engineer of the water department, Portland Oreg. At present, he is Pacific coast manager, Robert W. Hunt Co.

After the first two steps, comes the matter of awarding of the contract and the execution and fulfillment of the terms of this contract by the seller or contractor. Practically all of the standard specifications previously mentioned provide that inspection shall be made at the point of manufacture and generally define how this inspection shall be made and of what it shall consist. Therefore, regardless of where or under what conditions materials are purchased, it is essential and necessary to arrange for competent, honest and efficient inspection and supervision during the process of manufacture. Furthermore, to avoid delays and disputes this inspection or supervision must take place at the time the materials are being manufactured, rather than at the point of delivery or after the material has been painted or allowed to accumulate dirt.

This function of inspection may be performed by the purchaser himself or his duly authorized representative. Experience has shown that the most economical, logical and practical way to exercise this function is through the employment of independent inspectors who are not permanently connected with either party to the contract. Such inspectors, should be particularly experienced and competent to perform the services required. The duties of such inspectors are varied and many depending upon the class, type and method of manufacture. They must check the buyers' orders with those at the foundry, witness the operations of manufacture and the required tests, check dimensions and weights and thus eliminate, as much as possible, materials and workmanship that would tend to deviate in any manner from the intent and purpose of the specifications.

Buyers of pipe and appurtenances should be explicit as to the language and terms of their orders and specifications, thereby avoiding any misunderstanding between buyer and seller or principal and constructor. Vague, indefinite or general clauses that are intended to "pass the buck," should be rigidly avoided. As an illustration, such phrases as "good workmanship and materials only should be used," or "material should be tough, even and of good quality," should not be used. Such clauses are impossible of correct analysis or definition. The answer is sometimes made that "well, what is common practice?" This phrase is just as indefinite as the previous ones and its interpretation is a matter of individual personal opinion.

It has been found that in the manufacture of cast iron pipe there are approximately forty different defects for which an inspector must watch in addition to the inspection duties specifically mentioned. Only men that have had experience in performing this particular function should be employed for this service. Inexperience or uncertainty on the part of the inspector will only cause trouble and expense and often times delay. The manufacturers' organization will be antagonistic under such inspection and controversies will result. On the other hand, the psychological effect on the manufacturing organization is that it will naturally perform with greater efficiency when it is known that the inspection is to be rigid and honest but fair, and not careless and superficial. Inspection service has been found necessary, not because any reputable manufacturing plant intends to furnish a product that deviates from that specified in the contract, but because no human effort is infallible and no plant operates at one hundred per cent efficiency at all times. Only by especially experienced and independent inspection can errors and faulty materials be eliminated.

Metallurgical Research Aids Industry

By Robert E. Belt

CO-OPERATIVE research work in the iron and steel industry, up to this time at least, has been largely along metallurgical lines for the improvement of the quality and the standardization of the product.

The activities of the American Iron and Steel institute and the American Foundrymen's association, in particular, center around the collection and dissemination of production statistics, of research information on the technique of production, the best materials to use for a given purpose or product, approved compositions of metals for given uses, and methods of conducting tests of raw materials and of finished product. Considerable co-operative research along these lines has been conducted in the iron and steel industry extending over a period of years and the benefits of which have been substantial and far-reaching.

Two other organizations in the iron and steel industry—the National Metal Trades association and the National Founders association — have for a great many years conducted with marked success researches of conditions of employment, wage rates, labor turnover, apprentice training, etc., all of which are in the interest of industry welfare, stability and progress.

Still another type of commercial research somewhat prevalent among iron and steel associations, which may be new to some, is a fellowship of association employes in institutions of research, such as the United States bureau of standards, Carnegie Institute of Technology, University of Michigan, etc. The conduct of research work by associations in conjunction with and under the auspices of technical and educational bodies has many advantages and generally has proved quite successful. Facilities and equipment are offered by such research bodies for the conduct of specific studies, market practices and processes which could be utilized to advantage by a wide range of industries. It is both an economical and satisfactory method of conducting research studies and investigations and one well worth consideration by associations engaged in product research.

In the iron and steel industry a position of first rank in the successful conduct of both production and market research can be given the Electric Steel Research group, a co-operative organization of four producers of electric steel castings. Studies are made by experienced engineers of the most economical plant practice based on the experience and results of members of the group, studies of and reports on the proper metal compositions and analyses for castings of varying uses and purposes. Under market research, their activities embrace contacts with purchasing trades familiarizing the buyer, through a monthly publication, with their product research work and with facts pertaining to the product which he is using or may be thereby induced to use. The association, in a measure, is an agency of the buyer as its work insures him of a product which will give the service and per-

Group Research

VARIOUS groups in the iron and steel industry have from time to time undertaken work along the lines of co-operative research. However, much of this activity has been largely along metallurgical lines and has been directed toward the improvement of the quality and the standardization of the product. This article points out the co-operative research work that has been done by a number of associations allied to the iron and steel industry and more especially the foundry field. This article is from a paper presented at a meeting of the American Trade Association Executives held at Lake Wawasee, Ind., Sept. 26-28, 1929. The author is manager, the Malleable Iron Research institute, Cleveland.

formance to which he is entitled.

A line of product research, with considerable success to its credit is that conducted by the Malleable Iron Research institute, which comprises metallurgical research, standardization and certification of the product of member companies.

In the early days of the malleable iron industry the old tradition that one bad apple spoils the whole barrel was never more effectively demonstrated. Every manufacturer of malleable iron saw his business suffer as a result of the poor material that was put on the market. To establish the integrity of the product, therefore, and to enlarge the field of application, the institute determined to engage in a broad field of laboratory and metallurgical research to enable members to make a product of greater uniformity and of higher standards.

As the first step in carrying out this program, a research department was organized, and an eminent consulting metallurgist was retained with full authority to carry on intensive research work. The next step was to require that each member of the institute submit daily test bars from his plant to the consulting engineer. Each bar to be tested independently for tensile strength, yield point, elongation and other physical properties.

Then a study was made of the plant practices in the more progressive and successful plants. The improved manufacturing methods thus disclosed were published for the benefit of each member of the institute so that malleable iron might be standardized by uniform plant practice.

Later, engineers were employed to make periodic product inspections at the plant of each member company. These men were required to report on the plant practice followed in each individual case as affecting quality standards. Largely as a result of these activities the different physical properties of the product were improved over a period of about eight years from 40 per cent to 100 per cent.

It was felt that the product which resulted from this program of standardization and improvement should have in the trade some mark of distinction; consequently, it was decided to issue a certificate of merit to those plants designated as worthy of receiving special mention.

The requirements of an award for a certificate are, first, that the test bars from each day's production which are sent to the institute's laboratory must meet the required standards for ultimate strength, yield point, and elongation, and second, that the plant practice of the member must be such as to receive the endorsement of the institute's visiting engineer and inspector. The records of daily test bars are thus reinforced by personal investigation of plant methods so that the award is an index to high quality.

The certificates are issued quarterly and most members have bent every effort to obtain an uninterrupted record as certificate holders, even though it was necessary to revamp their equipment and plant practice.

For the protection of the purchaser, the institute publishes each quarter the names of the certificate holders and the list is carefully followed by many buyers in their purchases of the product. It is their assurance of quality, integrity, uniformity and definitely established physical properties.

Gray Iron Church Fence Endures

WHEN a motor truck recently broke through several sections of a fence surrounding a church at Brownsville, Pa., it created more damage than the elements had accomplished over a period of 80 years. The fact that the fence is of gray iron and with the exception of the broken sections, still is in good condition, makes the situation even more noteworthy.

In 1850, when Brownsville, located on the Monongahela river 40 miles south of Pittsburgh, was one of the leading candidates for urban supremacy of western Pennsylvania, John Snowdon & Sons were instructed by Christ Church of Brownsville to erect a fence about 200 feet long in front of its edifice. The church had been built in the same year. John Snowdon & Sons enjoyed an active business in Brownsville, building steam engines for river boats. A fence of cast iron was made and erected and has served since that time. The same company in 1830-32 made the cast iron mile markers for the National Pike, on which Brownsville is located. These markers still can be seen on perfect condition along the highway.

The broken sections are being replaced by the Reliance Steel Casting Co., Pittsburgh. It is interesting to note that C. L. Snowdon Jr., secretary of the company, is a grandson of the founder of the company that cast the original fence. The new sections are of cast steel for the sake of convenience, the Reliance company specializing in steel castings. Fig. 1 shows a single section of the original fence used as a pattern for casting the steel sections, and Fig. 2, a steel section.

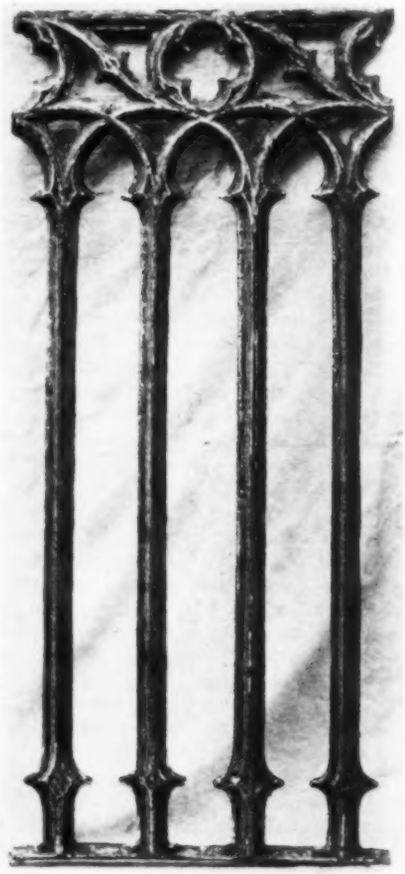


Fig. 1—(Left)—Section of Gray Iron Fence Used as Pattern for Replacement. Fig. 2—(Right)—New Section of the Fence Cast in Steel to Replace Broken Parts

Bill Tells of Molding a Smokestack – III

By Pat Dwyer

LAST Sunday afternoon Bill called around and found me engaged in the peaceful occupation of browsing through the almost endless pages of a couple of Sunday newspapers. Usually I only see a few scattered pages. Even before I have finished reading these remnants, three or four hungry readers have their hands out for them.

Early training prompts me to read a paper methodically, commencing at page 1 and following through in regular order, folding the pages properly, until I have seen all that is to be seen. Other members of the household follow a different system. When they are through, all the king's horses and all the king's men, backed up by the entire editorial, mechanical and composing room staff of the newspaper could not assemble the paper as it was before.

Once a year the family takes figurative wings to itself and flies away for varying periods. Some fly east, and some fly west, and some fly over the cuckoo's nest—wherever that is. Some time later, I organize the relief expedition, go in search of them and bring them home.

In the meantime, I can take my time reading the Sunday paper. Also when I am through with it I have the satisfaction of gazing on a stack of papers folded as neatly as when they left the newspaper building. At one time or another I have speculated on the probable tradein value of these papers, but up to the present, I have received no encouragement from any source. Outside of a canceled check, nothing seems to have as little value as yesterday's newspaper. With the easy informality of an old and trusty friend, Bill rummaged through the stack of papers until he found the rotogravure section. He volunteered cheerfully that this is the only part of the paper worthy of attention. The remainder of the stuff, murders, bombings, racketeering, divorces, robberies and sob stories of penitentiary mutinies, is just so much tripe. A disgusted snort accompanying the use of this simile convinced me that if all the opprobrious epithets in the English language were placed end to end like the tail on a dinosaur skeleton, the word tripe, would be absolutely the last button on the string. "Now, here," said Bill, "is a picture worth looking at. Something that will start more trains of thought and recall more pleasant memories than forty columns of that stuff on the front page."

He showed me a reproduction of a photograph of a military band taken some time during the Civil war. The caption stated that this was the first United States army band to enter Charleston, S. C., in 1863. It also was reputed to be the best dressed band to return to Cleveland after the war. The fourth man from the right with an alto horn draped negligently over his left arm, outlived all the others and died only a few weeks ago. He was the shortest man in the group, but was outranked by only a few in the luxuriance of the bush which covered his features. The bass drummer was comparatively bare faced, but the inevitable law of compensation was exemplified in the snare drummer whose eyes alone were visible above a noble beard that extended around and about the upper works and down to the fourth button of his tunic, or approximately to the peak of the wishbone.

Bill ran a practiced eye over the group.

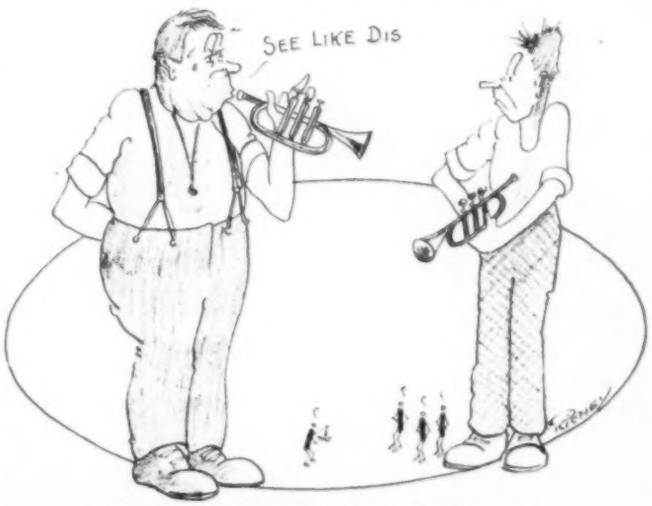
"A nice little band," he remarked, "but a trifle weak on the bass end. However, I readily can understand the difficulty they would experience in persuading any man to carry a big tubular b-flat bass horn around his neck for four years."

"They all look kind of solemn," I said, "I don't see a smile on a single face."

"You would look solemn," Bill replied, "if you had to play the same repertoire every day for months on end. I took my first cornet lessons from a veteran who had played in a Civil war band and he told me that when ever in later years he heard a missbegotten young cub essaying *Bonnie Eloise, the Belle of the Mohawk Vale*, he felt positively ill.

"Most of this veteran's reminiscences centered around Chattanooga with particular reference to the battle of Lookout mountain, or, as he always insisted on calling it, 'The battle above the clouds.' He never claimed full credit for the result of this encounter, but in a general way I gathered the impression that a few judicious words of his dropped into General Grant's ear induced that fighting man to send Hooker up Lookout mountain while Sherman attacked the right and Thomas engaged the center.

"According to all the published reports I have seen, Thomas' heroic storming of Missionary ridge was the decisive feature of the battle, but my ancient friend never wavered in his belief that the attack on Lookout mountain never was equalled, before or since; even though the result was non-decisive. "Those far away days with their blood and sweat, desperate hand to hand fighting, booming cannon, rolling musketry and choking, acrid powder fumes were recalled to mind recently when I visited Chattanooga and traveled in peace and comfort over a territory that was shell swept and shot to ribbons in the fall of '63.



What Grand Feet He Has for Beating Time

"The physical scars of war long since have disappeared in and around this bustling, progressive city, for a time the center of some of the fiercest fighting in that memorable struggle between the Federal and Confederate forces. Silent reminders remain in Chickamauga National Military park with its almost endless rows of little tombstones, and in the national park on the summit of Lookout mountain with its imposing monuments and bronze plates erected by the various states whose regiments served in the army of the Tennessee."

"How does it happen," I inquired, "that you have all this historical lore at your finger tips? Why, its almost 40 years since the old veteran showed you how to run the scale on a cornet and delivered monologs on the Civil war. Constant practice has kept you fairly familiar with the scale, but I tell you frankly, my lad, you impose too great a strain on my credulity if you expect me to believe that you remember names and dates, received at second hand and connected with a war that was over ten years before you were born."

"Well," said Bill, "I'll tell you. I made the tour in company with one of the gabbiest lads I've ever had the pleasure of meeting. For five hours, a constant stream of historical data, local references, funny stories and descriptive material flowed from his limber lips like goose grease through a tin horn. The fact that he has been driving tourists daily over the same route for several years may account in some measure for the finished character of his performance, but he must have been naturally gifted originally. He was one of those rare and fortunate individuals who had found the niche for which he was peculiarly fitted, a round plug in a round hole. Boy, did he fit? And how!

"The manner in which he brought his big blue bus to a stop, hopped nimbly from the driver's seat and across the sidewalk to the entrance to the Reed house where I was standing, reminded me of pictures I have seen of the old stage coaching days.

"Without preamble of any kind and in the heartiest manner he said: 'Brother, how would you like to come with me for a trip around Lookout mountain?'

"At one time or another I have been the grateful recipient of many evidences of proverbial Southern hospitality from men who whom I have come into contact. The extension of courtesies beyond the ordinary, although still deeply appreciated, no longer arouses the astonishment I at one time experienced. However, this sudden and generous offer from a total stranger left me gasping. Finally I rallied sufficiently to admit that nothing would suit me better than to accompany him as his guest on the jaunt.

"'Paying guest, brother' he corrected me genially, 'Paying guest is the word. Much as I hate to do it, I shall have to ask you to donate—in advance—the trifling fee, stipend, honorarium, or what have you, of two bones, ducats, simoleons or strips of the long green. Silver is an acceptable medium, but on the advice of my physician I must refuse checks, drafts, promissory notes and postage stamps. Hop in and let's go.'

He Seems To Lack the Perfect Faith

"We picked up about a dozen other passengers at various points before we finally turned south on Whiteside street and headed directly for the mountain. Traffiic was not particularly heavy on this straight, wide thoroughfare and I experienced no sense of alarm even though approximately half the time the driver's face was pointed backward so that we might have the full benefit of his priceless remarks. I did not feel quite so safe later when he continued the same practice while the old bus was negotiating grades and skating around hairpin turns on the almost perpendicular face of the mountain.

"At one point we stopped on a bridge that spans a double track cable railroad leading from the base to the top of the mountain. The driver explained many interesting features of this road and said that each car is attached to two cables.

"'Ye see,' he remarked, 'if one cable breaks, the other one gets it.'

"'That may be alright,' one of the lady passengers piped up, 'but suppose both cables break. What do they do then?'

"Both cables ain't never broke yet Ma'am', the driver responded with a quizzical grin, 'but even that contingency has been provided for. If both the cables ever do break, why, then the passengers will get it!'

"He was a merry lad, but he also had the gift of arousing other sentiments. We left the bus outside the imposing entrance to the extensive grounds where the monuments and other memorials have been erected to the boys who swarmed up Lookout mountain on that faraway day—and who never returned.

"In one of the open spaces the driver removed his cap and recited Theodore O'Hara's famous poem *The Bivouac of the Dead*, you know the one commencing:

The muffled drums sad roll has beat
The soldier's last tatoo;
No more on life's parade shall meet
That brave and fallen few.
On Fame's eternal camping ground
Their silent tents are spread,
And Glory guards, with solemn round,
The bivouac of the dead.

"The stately monuments, the quiet cathedral aisles under the lofty trees, the sense of loneliness and solitude incident to our presence on this lofty plateau with the shining bends of the blue Tennessee far below, may have been partly responsible for the effect, but I am here to tell you my lad, that never before had I thrilled so ecstatically to the spoken word. That lad was an artist."

Bill smoked away in silence for some time and then remarked that the last time he had been over, he had been commenting on several ways to mold a smoke stack.

"Now," he said, "under certain conditions a third method may be employed.

"In the event that a flask and pattern ring are available the molder has the opportunity of lifting the cheek and blacking the inside and outside faces of the mold. The job of raising and lowering the cheek is rather ticklish with only a clearance of ½-inch, but with proper care it may be accomplished. A cross suspended from the crane hook is centered accurately above the mold. The four slings are attached to the cross by turnbuckles. The crane block is hoisted until the slings are almost tight. Then the turnbuckles are tightened simultaneously by four men until the cheek floats free and level off the bottom. The four men then guide it carefully while the crane lifts it clear of the inside part of the mold. Then it is lowered on four supports erected at some convenient point on the floor.

"The check is not lowered in a haphazard manner on these supports. It is lowered in such a way that when it again is picked up, it

will hang level. This is done by stopping the lowering motion the instant the lower flange on the cheek touches the highest of the four supports. The space between the tops of the other three supports and the flange of the cheek then is filled with pieces of wood or iron, and wedges are driven in to insure an even support for the cheek when the crane is released.

"In some instances, where the crane can be spared for a short time, it is not detached. This is the better way, since it saves time in readjusting the slings and turnbuckles, and insures an accurate return of the cheek to its place on the drag. However, in a busy shop, it is not always practicable to hold a crane idle even for a short time and the cheek must be blocked up as described. "Closing the cheek over the inside part of the mold is facilitated by standing four long wood strips 90 degrees apart against the face of the core. Each strip is ⅜-inch thick, 3 inches wide and 6 feet in length. A slight amount of lateral motion is inevitable in lowering the cheek. These strips will prevent the cheek from rubbing against the core at any point in its descent. They are removed when the lower flange of the cheek engages the pins or guides in the drag and when they no longer are needed. A final inspection of the mold, also is made at this stage and any loose sand is brushed or blown away.

"In the preliminary stages of the foregoing method, the ring pattern is placed on a sand bed struck off flush with the upper flange of the drag that has been adjusted absolutely level. Manifestly if the bottom face of the mold is not level, the vertical walls will not be plumb and consequently the sand in the cheek will jam against the sand in the inside part of the mold when an attempt is made to remove the cheek.

"The pattern is adjusted on the bed in such a manner that it will be surrounded by a uniform thickness of sand in the cheek. This choice is dictated by three reasons. First, the skilfull molder has an eye for symmetry. Second, and most important, an even distribution of sand will insure a uniform weight in the cheek and consequently the cheek will hang plumb when suspended from the crane. Third, a uniform thickness of sand will cause the casting to contract uniformly and prevent possible distortion.

"The loose flange segments, or the flange cores are assembled against the lower edge of the pattern on the inside. If flange segments are employed, they can be removed after the cheek is lifted later. The inside of the pattern then is filled with sand and rammed to the top. Parting sand is sprinkled on the outside and the cheek flask is lowered into place.

"The cheek flask must be provided with a sand strip, a lifting ring or a set of chuck bars. That flask, of course, will be built up of many parts and the foregoing equipment is required only in the bottom section. Also for convenience in ramming, only one section is handled at a time. The parts of flask are clamped or bolted together as the building progresses. With a sand strip, or where the chuck bars do not touch the joint, gaggers will be required to carry the sand. No gaggers are needed with a lifting ring or where the chuck bars touch the joint and where they are spaced 6 inches apart. This does not apply with all sands. Where any doubt exists, prudence will suggest the use of gaggers.

The Passengers Add to Their Store of Knowledge

"Sand then is rammed in the space between the pattern and the cheek flask and up to the top of the pattern. The pattern then is drawn up 6 inches at a time and additional sand is rammed inside and outside until the pattern has been drawn up to the required height of 6 feet. The top joint is slicked on the outside and the inside flange is formed in the manner previously described either with cores or with a segment of flange pattern. The pattern then is removed and the cheek is lifted off, finished and replaced after the inside and outside of the mold have been dried either on the floor or in the oven. A skin drying is all that is necessary and this may be accomplished on the floor either with a torch, or with coke or wood fires. If gas is available it may be utilized readily. The top is covered with cake cores and the pouring basin is made up as was described in the preceeding instance.

"With a drum pattern the procedure is slightly different. The drum is placed on the prepared bed and parting sand is sprinkled around the bottom joint on the outside. The sand is rammed around the outside of the pattern. Then the pattern is drawn up by successive stages and additional sand is rammed until the desired height is reached. The drum pattern then is removed and lagging strips ½-inch thick and approximately 2 inches wide are erected close together against the sand face. A 10-penny nail inserted in the sand at the top of each strip, will hold it in place until sufficient sand has been rammed against them on the inside to hold them in place. The flange segments or flange cores are adjusted in place at the bottom and then the core or inside part of the mold is rammed to the top. The strips then are removed one at a time with a pair of pincers, and the mold is parted, finished, dried and reassembled. "If no flask is available, any of the foregoing methods may be followed with the exception, that the bottom parting is made on the inside and a circular cast iron plate provided with four long steel loops, is employed for lifting the inside part of the mold."

Issues Catalog

The General Electric Co., Schenectady, N. Y., has issued a new edition of its general catalog, which has 1146 pages and contains either actual or representative listings of the entire manufacture of the company. Information pertaining to apparatus and supplies employed in every phase of electrical application covered by the General Electric Co. is included in the catalog. The catalog supersedes all previous catalogs issued by the company, with the exception of catalogs 6002 and 604A which contain more complete information on special lines of the company's products.

Revise Safety Code

The American Standards association, New York, in co-operation with the United States department of labor, manufacturers, and other interested organizations has revised the safety code for woodworking plants. One of the important parts of the revision is the safe limiting speeds for circular saws. Copies of the bulletin may be obtained from the superintendent of documents, Washington, for 10 cents. Pattern-making establishments and foundries operating pattern shops should have a copy of the bulletin on file.

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Casts Gear Blanks Centrifugally

The Founding of Bronze Gear Blanks, by Francis W. Rowe, *Foundry Trade Journal*, London, June 19 and 26, 1930.

Several methods are utilized for the casting of bronze gear blanks. Among them are the sand, chill and centrifugal methods. In this paper, which was presented at the annual convention of the Institute of British Foundrymen, the author describes the advantages of the centrifugal method over the others and explains some of the methods used. The value of bronze for gear blanks is due chiefly to its low coefficient of friction when working against steel. It is utilized mostly in spiral and worm gears. According to the author, not much variation in composition exists between various manufacturers. Usually a tin-phosphorus bronze is used in which the tin varies from 10.5 to 13.0 per cent and the phosphorus from 0.1 to 0.5 per cent. The structure of a bronze of that composition consists largely of the alpha-delta eutectoid embedded in a matrix of copper-tin alpha solid solution.

Accurate control of raw materials is one of the requirements of successful nonferrous practice. All material for charges should be weighed and records kept. The author then describes the melting practice in the foundry in which he is employed. That foundry uses a battery of coke-fired reverberatory furnaces supplemented by pit-fire and induced draft, tilting furnaces for special heats. He then gives some advantages of reverberatory furnaces.

The following melting practice is followed: Weighed charges are transported along rails on the charging floor by a special truck. The ingot copper and alloy are melted first under a protective covering. When the charge is melted and superheated to about 1300 degrees Cent. (2372 degrees Fahr.), the slag is removed from the surface and the phosphor-copper added. The charge is rabbled thoroughly before the tin and alloy additions are made and then is rabbled again to insure thorough mixing and tapped into preheated ladles.

According to the author, the following requirements are incorporated in the ideal gear blank: Should have a structure containing the hard alpha-delta entectoid and soft, resilient, copper-tin solid solution; grains must be heterogeneously oriented to secure maximum strength; the method of casting should not be such that the periphery is made dense at the expense of the interior. He then explains how other methods than the centrifugal process fail to produce castings having those requisites. The only limitations of the size of casting that may be made by the centrifugal method are economical. He then describes the apparatus used and explains some of the advantages of that casting method. He also states some of the principles of foundry practice in making centrifugal castings.

Heat Treats Cast Iron

Heat Treatment of Cast Iron, R. Whitfield. *The Iron & Steel Industry*, London, June, 1930.

Many foundrymen, while aware that cast iron is heat treated, have no knowledge of the processes or of the metallurgical changes that take place. In this article, the author explains theoretically the mechanism of the heat treatment of cast iron. He first explains by use of the iron-carbon diagram, the possible structures that may be obtained and the causes of primary structures. The next phase of the explanation deals with the influence of the various common elements found in cast iron. The author states that three types of heat treatment of cast iron are: Heating the castings to a low temperature, up to 550 degrees Cent. (1022 degrees Fahr.); heating to a temperature higher than the critical point, from 650 to 870 degrees Cent. (1202 to 1598 degrees Fahr.); and heating to 700 degrees Cent. (1292 degrees Fahr.). The first process is used in ageing castings to relieve internal strains; the second softens the iron and increases machinability; and the third, which is carried on in the region of the critical range, promotes the formation of fine nodules of graphite in nests of ferrite and good physical properties. Heat penetration may be assumed to be ⅛-inch per five minutes. All castings should be heated slowly to promote uniform penetration in light and heavy sections.

Sorts Aluminum Scrap

A Rapid Method for Sorting Aluminum Scrap, by Robert J. Anderson, *The Metal Industry*, London, July 11, 1930.

Difficulty often is encountered in nonferrous foundries and in secondary aluminum practice in determining the composition of aluminum scrap. C. S. Taylor and J. D. Edwards, in their paper, "Thermo-Electric Tests for Aluminum-Manganese and Other Alloys," *Transactions*, American Electrochemical society, vol. 56, p. 53-56, describes an apparatus which assists in determining the composition of that kind of scrap. The instrument is based on the measurement of the thermal electromotive force of a couple, one element of which is aluminum and the other an aluminum alloy. As utilized in practice, sorting is done by observation of relative thermo-electric potentials, the hot junction not being held at any definite temperature. Various impurities in the scrap give plus or minus deflections on a galvonometer in accordance with the element and the amount present. The apparatus consists of two tips connected to a galvonometer by aluminum wire. One of the tips may consist of an electric soldering iron with the copper tip replaced with one of aluminum. Tips usually are made of 99.3 per cent aluminum. A 100-watt lamp is placed in the line to the soldering iron in series with the iron. The line to the iron is in parallel with another line containing a resistance sufficient to allow 3 volts to be delivered to the galvonometer. The soldering iron is kept hot during operation of the apparatus. Scrap is placed across the terminal tips and the deflection of the galvonometer noted. The present article deals with the methods used in sorting scrap containing commercial aluminum and that containing 1.00 to 1.50 per cent manganese.

Examine Structure of Bronze

Gegossene Aluminiumbronzen—II (Cast Aluminum Bronzes—II), by W. Claus and F. Goederitz, *Die Giesserei*, Duesseldorf, Germany, June 20, 1930.

This article is a continuation of a series of articles on cast aluminum bronzes which appeared in the Feb. 14 and 21 issues of *Die Giesserei*. It deals with structural formation and includes data on macrostructure, microstructure, segregation, and nonuniformity of the mixture of four aluminum bronzes. One of the bronzes contains 4.5 per cent aluminum and others contain 7 and 10 per cent aluminum. The fourth alloy contains 10 per cent aluminum, 2 per cent each of manganese and iron, 0.80 per cent nickel, 0.38 per cent tin, and 0.08 per cent zinc. Each of the alloys was cast in dry-sand, green-sand and chill molds with the castings standing both vertically and horizontally. The results showed that alloys binary in nature containing up to 7 per cent aluminum increasingly agree in structure with the constitution diagram of copper-aluminum. Agreeing that given assumptions enter into commercial castings of 10 per cent aluminum bronze, those always correspond to the constitution equilibrium of the diagram. Zoned copper and aluminum-rich primary crystals and secondary, structural components Fe, Mn, Ni, Sn, Zn and Pb first are observed in the special bronze. The arrest point was found for the phenomenon of inverted segregation which is conspicuous with the 7 per cent bronze as vertical segregations in the feeding head.

PREDESTINATION
Made Him a Foundryman

IF you were to ask John Cameron, J. P., how it happens that he is managing director of Cameron & Robertson, South Bank Ironworks, Kirkintilloch, which as everyone knows, is only a short distance from Glasgow in Scotland, he probably would tell you it is all due to the well known law of predestination.

Had he flourished at an earlier period he would have worn the tartan, a black-cock feather in his bonnet, a *skean dhu* in his stocking and a broad claymore in his hand, after the fashion of men of the Cameron clan from a time when the memory of man runneth not to the contrary. Men of simple faith, strong convictions and passionate loyalty to any cause they espoused, men of the Cameron clan helped to make Scottish history in the days when history was hammered out on the anvil of war under pike and spear and battle axe and ringing steel blades.

Cameron men rallied around the banner of blue at Ayrsmoss where the scarlet blood of Richard Cameron mingled with the purple and gold of the heather and gorse. Cameron men came out in the '45 and left their bones to bleach white after they had been picked clean by the crows and the corbies, after Culloden. Cameron men in Aytoun's famous poem were in the group which stormed a fortress island in the Rhine:

> Rise hill and glen, rise crag and wood. Rise up on every hand.
> Again upon the Garry's banks, on Scottish soil we stand.
> Again I see the tartars wave, again the trumpets ring!
> Again I hear our leader call—"Upon them, for the King!"
> Stayed we behind that glorious day, for roaring flood or linn?
> The soul of Graeme is with us still, Now, brothers, will ye in?

Oh, aye, yon Cameron clan is aye a fighting clan, but times change and men change with them and present day battles are waged mostly over director's tables, instead of over the moors and the mosshags. Competition and due process of law have taken the place of the ready spring, the slashing two-hand stroke of a broad claymore or the lightning like and vicious stab of a *skean dhu* snapped from the galligaskins.

As a result, John Cameron with the moustache and eye brows of a highland chief, the deep set eyes of a thinker and the mind of a poet, is managing owner of a gray iron foundry in the bonny town of Kirkintilloch. If he had been born 300 years earlier he would have been out in the mountains with a sword in his hand and a price on his head and whistling "Oh! Charlie is my darling!" as gaily as any thrush or blackbird in the dell.

In common with all the Highland clans, the Camerons trace their descent back to a remote period where history merges into nebulous tradition. Some scholars claim that the first mention of the clan is in a sprightly volume of the fourteenth century entitled De Cameron, but this reference is disputed by other equally learned savants who maintain that the late Mr. Giovani Boccaccio was famous for the purity of his prose and consequently would have used the article *The* instead of the vulgar *De*.

For all practical purposes the present day history begins in 1868 when the late John Cameron and the late John Robertson joined forces to form the firm known by their names up to the present and to establish a foundry where light gray iron castings are made in great profusion. In 1890 Mr. Robertson retired leaving Mr. Cameron, sole partner. Mr. Cameron died in 1899, the same year in which the firm was reorganized as a private limited company with Mr. Cameron's sons, the present John and T. P., as managing directors.

There it is predestination. His father started business in a certain year. John was born in a certain year. He left school at the age of 16 and entered the plant for a thorough course in the pattern shop, foundry and fitting shop. When his father died he was fitted by environment, trading and inclination to assume the management of the plant and to carry his activities to an extent never contemplated by the original founders of the little plant in Kirkintilloch.

He established a plant known as the Eastern Light Casting Co., in Kulti, province of Bengal, India, for the manufacture of cast iron railroad ties and rice pots. The cast iron tie is the only form of tie ever tried, capable of resisting the ravages of the Indian ant. Even so it is claimed by competent railroad men that the ants are equipped to chew any kind of iron with a Brinell lower than 200. The pots of course are for cooking the rice with which the coolies are fed while building and maintaining the railroads.

Mr. Cameron has traveled extensively in connection with his own business and with that of the foundry industry in general. He has been to India twice, once to Egypt and in 1916, while Europe was in the throes of the World war he had a jaunt through Russia.

Since joining the Institute of British Foundrymen in 1918 he has taken an active part in the activities of that institution. Until 1921 he was representative of the Scottish branches, and in that year he was appointed a member of the general council. In 1924 he was elected vice president and served as president in 1925 and 1926. He has contributed many papers on technical subjects, including one on the Poumay cupola presented before the Scottish Branch Institute of British Foundrymen, Glasgow, March 8, 1930.

He is a regular attendant at all the home and foreign foundry conventions and as president of the I. B. F. was one of the leaders of the group of overseas foundrymen who attended the International Foundry congress in Detroit, 1926 and afterward made a tour of the country.

Predestination led him to his present position as a manufacturer of items used in the arts of peace, but for a few years of his career he was as actively engaged as any of his bellicose ancestors in the game of war. That was while he was making immense quantities of semi-steel shells during the war.

The Shakeout

DAN M. AVEY, *Editor*
FRANK G. STEINEBACH, *Managing Editor*
PAT DWYER, *Engineering Editor*
EDWIN BREMER, *Metallurgical Editor*
CHARLES VICKERS, *Nonferrous Editor*
NORMAN F. HINDLE, *Assistant Editor*

¶ Active Co-operation Pays

COMMENT has been made frequently on the phenomenal growth of the automobile industry, and the excellence of the mechanical features and appearance of its product. Many reasons have been propounded which have been important, but undoubtedly many have overlooked one feature that has a responsible part in placing the industry on its present high plane. That feature is the work done by its technical organization, the Society of Automotive Engineers. Through its members, the society has conducted a searching supervision of every part of the motor vehicle. Changes of design, new methods of manufacture, and new conceptions of service and maintenance have been weighed, and the best of these have been made free to all.

THE automotive industry is noted for its lack of secrecy. Few of the plants refuse to allow their competitors to enter their experimental rooms and shops. Consequently, that policy of promoting investigation and the free interchange of information have had far reaching results, and is an excellent illustration of what a technical or trade organization can do through the co-operation of its members. The foundry industry can advance just as rapidly and progressively, if the individuals and companies will become active participants in the technical and trade organizations in the foundry field.

¶ Say What You Mean

A RECENT news item carried by trade publications and newspapers and credited to the bureau of standards, contains the following statement:

> With the increasing use of steel castings for industrial purposes, heavier demands as regards specifications are being made. Greater strength and ductility are demanded, foundrymen often being called on to produce castings having a minimum strength of 60,000 pounds per square inch, a *stretch* of 24 per cent on a 2-inch gage of 0.505 inches in diameter, with a reduction in cross sectional area of 35 per cent.

The above is a statement of the minimum American Society for Testing Materials standard for soft, class *B*, steel castings and has been a standard for years. It also is the minimum standard for the weakest class of steel castings made where a specification of tensile strength is necessary. The writer has improved upon the technical language and has substituted the word stretch for *elongation* and elaborated the standard quotation, reduction of area, to reduction in cross sectional area.

THE statement, perhaps unintentionally, implies that steel foundrymen are encountering difficulty in producing steel castings within that standard. Such is not the case. The poorest grade of steel castings has met that standard easily for years and will continue to do so in the future. On the other hand, alloy steel castings with special heat treatments can be made to develop a tensile strength of 200,000 pounds per square inch. Further statements give the impression that sound castings are difficult to produce in green sand molds whereas thousands of tons are produced annually.

SUCH information might be construed as detrimental to the steel foundry industry as it gives manufacturers of competitive products the opportunity to pointing out the ease with which they can exceed the stated specification. Often, if such a case arises and an investigation is launched, it is found that the casting equals if not exceeds the properties of the competing product. Statements coming from an authoritative source, should be worded to express what is desired and not in a way that can be misconstrued so easily.

¶ Investigate Specialties

FREQUENTLY, in times of busines depression when orders cannot be secured in sufficient volume to maintain foundry operations at a profitable level, the management considers the possibility of a specialty which may be produced in part or in its entirety in the shop and thus offer a means of filling the low points in the business curve.

Before undertaking the production of a specialty, foundrymen should investigate the patent situation carefully to avoid expending money for rigging and equipment, only to find later that the particular specialty infringes upon patents held by others.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

VICTOR STOBIE, since 1912 a member of the Institute of British Foundrymen and during 1927 and 1928 president of the Newcastle branch of the society, has been elected junior vice president of the institute. Mr. Stobie is a native of Birmingham, Eng., and received his education at St. Maur's school, Paris. Later he studied electrical engineering at University college, Sheffield, and then entered the metallurgical department of the same institution under the tutorship of Professors Arnold and McWilliam. Later he established the Sheffield Annealing Works, Sheffield. Mr. Stobie established the Stobie Steel Co., Sheffield, in 1909. He sold his Sheffield interests in 1912 and established an electric steel works on the Tyne at Dunston. At present Mr. Stobie is governor of the Surtees memorial which holds examinations in foundry technique at Newcastle and Glasgow on alternate years and makes awards. He has presented papers on various technical subjects at meetings of the Iron and Steel institute, the Institute of British Foundrymen, and other societies and technical groups.

George F. Nye, president, Dobbie Foundry & Machine Co., Niagara Falls, N. Y., has been elected a director of the Power City Trust Co., formed by the merger of the two of the largest banks in Niagara Falls.

H. A. Lomax, formerly associated with the Duquesne Steel Foundry Co., Pittsburgh, has been appointed general manager in charge of the Wheeling Mold & Foundry division of the Continental Roll & Foundry Co., Chicago.

H. E. Field, formerly president and general manager, Wheeling Mold & Foundry Co., Wheeling, W. Va., recently merged with Duquesne Steel Foundry Co., Pittsburgh, and Hubbard Steel Foundry Co., East Chicago, Ind., to form Continental Roll & Steel Foundry Co., Chicago, has been made vice president and treasurer of the parent company.

Byron M. Bird, for the past ten years with the United States bureau of mines, has been appointed chief concentration engineer, Battelle Memorial institute, Columbus, O., in charge of research work on both ore dressing and coal preparation. He has been located at the Alabama station of the bureau of mines since 1928, recently as supervising engineer in charge of the southern experiment station.

A. M. Maddock has been appointed vice president and sales manager, eastern division, Standard Sanitary Mfg. Co., Pittsburgh, plumbing fixture manufacturer, a division of American Radiator & Standard Sanitary Corp., New York; H. F. Beglen

Victor Stobie

becomes vice president and sales manager, central division; F. A. Kales is vice president and sales manager, western division; R. L. Ottke, vice president and sales manager, brass division; and C. B. Nash, vice president and director of publicity, the latter two with headquarters at Pittsburgh. These vice presidencies are newly-created.

H. S. Bartholomew, formerly associated with Cooley & Marvin, Boston, cost engineers, has been appointed consulting head of the newly created cost engineering department of the Steel Founders' Society of America. Mr. Bartholomew will have offices in the headquarters of the Steel Founders' society, 932 Graybar building, 420 Lexington avenue, New York.

Adds Ten New Members

Gray Iron Institute, Terminal Tower building, Cleveland, recently admitted the following firms to membership: Union Mfg. Co., 296 Church street, New Britain, Conn.; Taylor & Fenn Co., 54 Arch street, Hartford, Conn.; Watson Machine Co., 74 Railroad avenue, Paterson, N. J.; Treadwell Engineering Co., Twenty-fifth and Lenox streets, Easton, Pa.; Lancaster Iron Works, 618 North Pine street, Lancaster, Pa.; Hertzler & Zook Co., 28 Maple street, Belleville, Pa.; Samuel J. Creswell Iron Works, Twenty-third and Cherry streets, Philadelphia; Wolf Co., Wolf avenue, Chambersburg, Pa.; Alexandria Iron Works, Box 214, Alexandria, Va.; and Temple Foundry, Inc., Box 155, Alexandria, Va.

Peck, Stow & Wilcox Co. Elects Officers

George S. Case was elected president of Peck, Stow & Wilcox Co. at a recent meeting of the company. Other officers named are Charles F. Treadway, executive vice president and treasurer; Frank L. Wilcox, vice president; Otto J. Blank, vice president Mark J. Lacey, vice president, and Arthur G. Potter, secretary and comptroller. The company has plants at Southington, Conn., and Cleveland. It also maintains an office and warehouse in New York.

Will Study Electric Furnace Iron

One of the features of the Detroit meeting of the American Electrochemical society, to be held Sept. 25 to 27, will be a round table discussion on electric furnace gray iron. The session will be informal and no stenographic report will be made. Arrangements have been made by A. T. Hinckley, chairman of the electrothermic division of the society, and H. M. St. John, secretary and treasurer of the division.

Announces Meeting Date

The next regular meeting of the Steel Founders' Society of America will be held at the William Penn hotel, Pittsburgh, Sept. 10 and 11. The October meeting of the society will be held at the Pennsylvania hotel, New York, Oct. 23 the day preceding the New York meeting of the American Iron & Steel institute.

Change Convention Date

Gray Iron institute, Terminal Tower building, Cleveland, has changed the date of the third annual convention from October 15 to Oct. 8. The change was necessary because of considerable activity in Cleveland during the former week and to provide ample hotel and other facilities.

Rotary Furnace Uses Powdered Coal

Whiting Corp., Harvey, Ill., manufacturers of foundry equipment, recently acquired American rights to a rotary furnace developed at the J. D. Brackelsberg plant, Milspe, Germany. The furnace is pulverized coal fired and may be used for the production of black and white-heart malleable iron, gray iron and steel. It also may be employed in melting some nonferrous alloys.

The complete unit includes pulverizing and feeding equipment for coal, charging floor, stack and connections, fans for primary and secondary air, charging equipment and furnace drum. The drum is a steel shell with removable conical ends. Two steel tires form an integral part of the drum on which it rotates. The furnace also is equipped with a reversing motor which permits it to be rotated in either direction at a speed of 1 to 1½ revolutions per minute. The motor also serves as a drive for rocking the furnace. The overall length of the furnace is 20 feet and the shell diameter varies with the capacity. Fig. 2 shows a 5-ton furnace in tilted position. Fig. 1 shows a typical installation of the rotary unit.

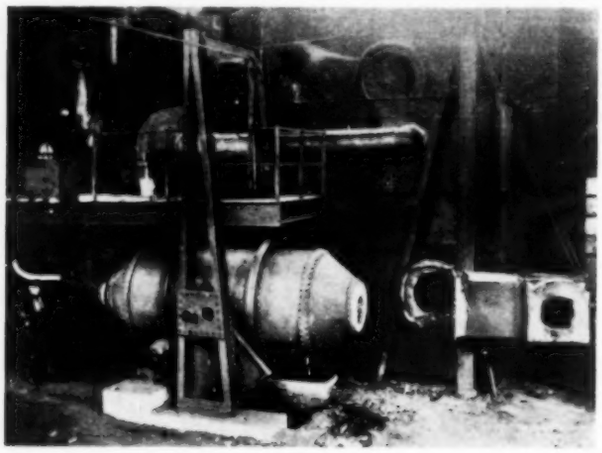


Fig. 1—Rotary type Furnace in Operation in a Typical Installation

Inside diameter of the furnace is approximately one half of the shell diameter. An acid or silica, rammed or monolithic lining is recommended. It is claimed that if proper care is given the lining, 200 to 250 heats may be tapped before relining is necessary and then only 50 per cent of the original amount is needed. The furnace may be rotated as soon as the heat is started or fired in a stationary position until melting begins. Abrasive action on the lining is greater when rotated with a cold charge.

The furnace also is equipped with a tilting mechanism. It is utilized in relining, slagging off and charging. The furnace is tilted to a vertical position for relining and to a sloping position for charging. When in the vertical position, a safety strap prevents the furnace from falling out of the tilting cradle while tension bolts take the load off the flanges of the cradle journals.

The manufacturers point out that this type furnace will melt one ton of malleable or gray iron with 16 to 18 per cent coal. It is claimed that high efficiency is obtained by rotating the shell which brings the hot lining underneath the charge while the flame is over it and by using a specially designed burner with a low rate of fuel consumption. The furnace burns 7 to 10 pounds of coal per minute and a complete cycle including charging, melting and tapping of maximum heats on a 2½-ton furnace requires 3 hours, 4 hours on a 5-ton furnace and 6½ hours on a 10-ton furnace.

While the furnace requires a longer time for melting a ton of iron than the air furnace, is less fitted for continuous melting than the air furnace, and the cost of production of a general grade of gray iron is greater than in the cupola, it is well suited for the melting of high grades of iron, such as pearlitic, alloy and low carbon and the final composition of the iron produced may be controlled easily. As temperatures over 2800 degrees Fahr. have been obtained, the furnace may be utilized for the production of irons where a high temperature is required or where a high temperature is necessary to break down the basic structure of an alloy addition. Other advantages claimed for the furnace are metallurgical losses approximately equal to the air furnace when pulverized coal is used; high fuel ratio; low operating labor cost; low repair labor cost; low refractory cost; and uniform metal.

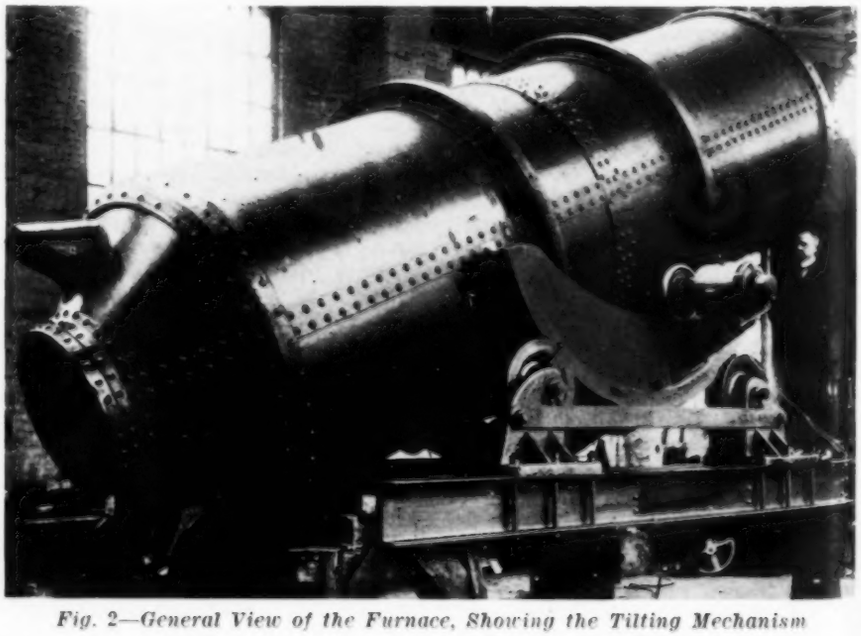


Fig. 2—General View of the Furnace, Showing the Tilting Mechanism

Designs Thermocouples for Brass Foundries

Illinois Testing Laboratories, 141 West Austin avenue, Chicago, has introduced a thermocouple for the determination of temperatures of molten brass, bronze, copper and other nonferrous alloys. It is a portable pyrometer designed especially for foundry use. The unit is self-contained and made to eliminate accidents to the instruments and workmen. The indicator always is close to the operator to facilitate quick and accurate readings.

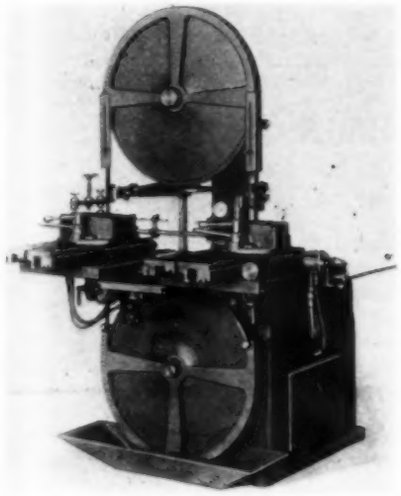
The thermocouple operates on the thermoelectric principle and consists of a millivoltmeter connected to the fire end by a pair of alloy extension wires enclosed in a supporting arm. When the exposed end of the thermocouple is heated, an electric current is set up which travels through the wires to the indicator. The current generated in the fire end increases with the amount of heat and deflects the pointer on the millivoltmeter over the scale which is calibrated in degrees Fahr.

The instrument is made in six models. Two are designed for crucible or ladle use only while the

others may be used for determining temperatures in both the crucible and the furnace. Two models designed for molten brass, bronze and copper are equipped with a special fire end which assures the temperature of the molten metal at the tip of the couple.

Introduces Low Pressure Hydraulic Feed

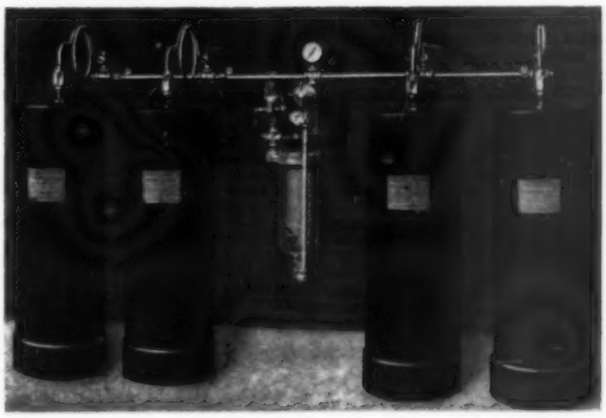
William Laidlaw, Inc., Belmont, N. Y., recently has introduced a new low pressure hydraulic feed for metal cutting band saws made by that company. The feed consists of the following parts: small rotary type piston pump; oil reservoir; pressure regulating valve; relief valve; pressure gage; cylinder; piston; control valve; and the necessary piping to conduct the oil from the reservoir through the pump and cylinders and back to the reservoir. The pump, reservoir and all piping except the short flexible metallic hose connections to the cylinders are housed in the base of the machine. The pump is connected directly to the main drive shaft.



Cylinder at the Right Controls the Feed of the Carriage

The accompanying illustration shows the hydraulic feed attached to a metal cutting band saw. The saw is of the double cutting type and consequently requires the use of two cylinders. Stationary cylinders are mounted on the table tops near the movable carriage to which the piston is connected directly. A chamber is provided between the brass lining of the cylinders and the side walls into which oil is pumped from the reservoir through a ported rotary valve. The chamber is divided into two compartments by a ring cast on the inside of the cylinder and bored to fit the outside of the brass lining. The rotary control valve is located so that its center coincides with the dividing ring and oil can be admitted to either end of the cylinder. Oil is returned to the reservoir through an adjustable needle valve which controls the forward feed speed of the carriage.

When the control valve handle is moved to its extreme position, the ports are opened fully, providing a rapid return of the carriage. An adjustable tappet controls the valve and stops the feed when the carriage has traveled a predetermined distance. A positive stop is attached to the front vise jaw which prevents the saw from cutting into the vise.



Cylinders May Be Used Singly or in Groups of Two, Three or Four

Manifolds Are Designed for Small Users

Oxweld Acetylene Co., 30 East Forty-second street, New York, has placed on the market two, new-type manifolds for small users of oxygen and acetylene that find it necessary to have a number of welding stations, but the consumption of gases does not warrant the installation of an acetylene generator and a large oxygen manifold. The 6-cylinder type, oxygen manifold is the wall type and has the duplex feature by which three cylinders may be in use while the others are being changed. The 4-cylinder acetylene manifold shown in the accompanying illustration also is the wall type. Every cylinder lead has a valve in the header so that each cylinder is independent of the others. That feature makes it possible to use any number of cylinders while the empties are being changed. Each cylinder connection is fitted with a flash arrestor and the manifold is supplied with connections for acetylene cylinders.

Conveyor Design Uses New Principle

Clark Tructractor Co., Battle Creek, Mich., recently has introduced a new, portable, flexible, power-driven, elevating and tiering conveyor which involves a new principle of design. The apparatus consists of two, externally spiral, tubes which are rotated toward each other by a power head. Objects placed on the conveyor travel forward rapidly with perfect balance. It is claimed that the new type apparatus materially reduces handling costs of bags, bales, bundles, crates, and boxes. Experiments are being conducted in handling products without packing.

Spiral Tube Conveyor Delivering Goods to Freight Car

A standard unit consists of six, 8-inch dual sections and a power

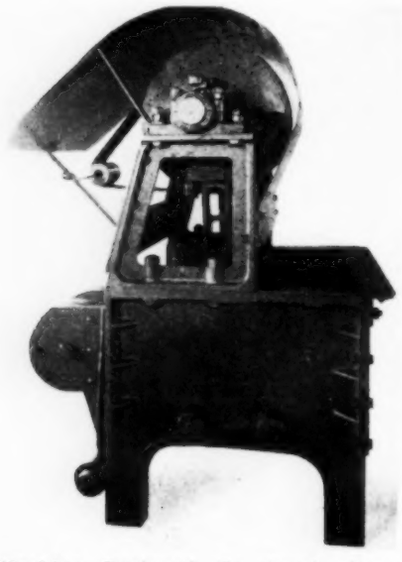
head. Each section is light and is joined to the assembly with an automatic lock. The unit is assembled and disassembled easily. Flexibility is secured by the ability of any joint to be tilted to a 15 degree angle horizontally or 15 degrees upward and 10 degrees downward. Sections may be supported by the material that has been stacked when objects are being elevated.

Hurdle sections permit a number of conveyors to be hooked together to form a continuous line of any desired length. Left and right spiral chutes are provided for shunting the load from one conveyor line to another. An extension to the power head may be plugged into any power line. Two complete 50-foot conveyors may be disassembled and loaded into a factory trailer in 15 minutes. The power head weighs 365 pounds; each 8-inch dual section, 140 pounds; and the entire 50-foot assembley 1205 pounds.

New Crusher Reclaims Core Sand

Newaygo Engineering Corp., Newaygo, Mich., has introduced a new crushing machine shown in the accompanying illustration. The machine is designed for breaking down cores from the shakeout, or those rejected by the inspectors, and also for crushing cupola slag and similar materials.

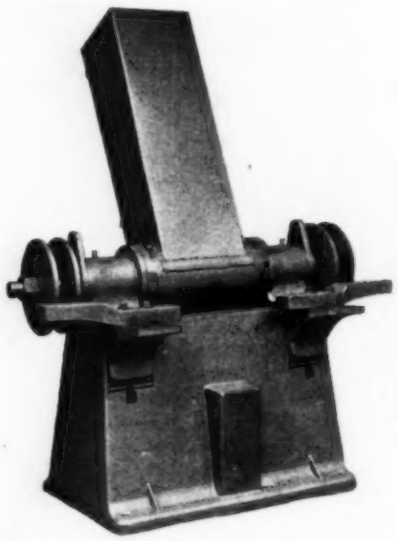
The new machine is built to crush cores fine enough to release the iron reinforcement which may be recovered by a magnetic pulley. The design of the crusher is such that this is accomplished without distorting or bending the iron reinforcing in the cores. Thus, the expense of straightening the reinforcing rods or pipes is minimized. The crusher is a slow speed machine operating with a gravity crushing principle which admits of operating at a low maintenance cost and with low horsepower. The size machine shown in the accompanying illustration has a 36 x 12-inch jaw opening and operates with a motor of from 3 to 4 horsepower.



Machine Designed To Crush Cores and Cupola Slag

Uses Belt Guard

The belt driven grinding machine shown in the accompanying illustration was built for a large agricultural implement manufacturer by Ransome Grinding Machine Co., Oshkosh, Wis. The machine is driven by a belt from an overhead countershaft. The belt is protected to a height of 7 feet by the guard shown in the illustration. The guard is so constructed that it may be tilted to any angle necessary to accommodate the position of the countershaft and grinder. The back part of the guard is equipped with a large door which is hinged allowing ready access to the belt for repairs. In use, these machines are designed for operating 24-inch wheels at 9000 surface feet per minute.



The Guard May Be Tilted to Any Belt Angle

Dual Operation Provided in New Cleaner

A new cleaner that does double duty about the shop has been developed by the United States Electric Tool Co., Cincinnati. The new tool provides a suction or vacuum cleaner applicable to car interiors, stock bins, etc., and by removing the dust bag and changing the location of the hose a blast of air may be had for drying or for cleaning motors or other equipment.

As illustrated, the outfit is portable and easy to handle. By hanging the motor and fan over his shoulder, the operator can apply the cleaner to cramped or difficult jobs.

The Cleaner Handles Easily and Is Applicable to Shop Needs

The body is of aluminum designed for light weight. A universal motor for either direct or alternating current is provided, and control is supplied by a quick-make, quick-break switch. The outfit can be had in two sizes, the smaller weighing 7½ pounds and the larger 9½ pounds.

Retires from Business

J. T. Boderick, secretary, manufacturing committee, General Electric Co., Schenectady, N. Y., has retired from active business after 41 years continuous service with the company. He began his career with the Thomson-Houston Co., Lynn, Mass., in 1889 and served on the staff of E. W. Rice Jr., later president, General Electric Co. When the latter company was formed, Mr. Boderick was appointed secretary of the manufacturing committee, a position he held for 36 years.

Plating with Chromium

Good chromium plating practice according to Richard Schneidewind in *Commercial Chromium Plating*, depends upon the plater's ability to maintain correct and identical conditions in four essentials which include: Temperature of solution in contact with the work; current density on the surface of the work; condition of the surface of the work, and composition of the plating bath. The bulletin mentioned may be obtained from the department of engineering research, University of Michigan, for 50 cents.

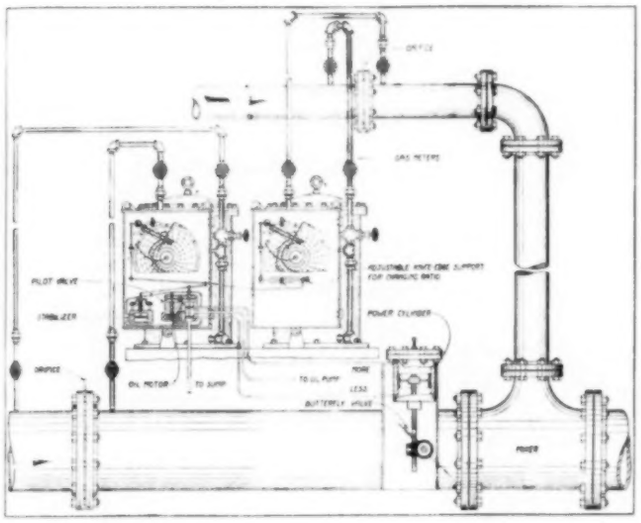
Despatch Oven Co., Minneapolis, has reorganized its Chicago office and has appointed W. S. Appleton district sales manager. J. H. Hopp will assist Mr. Appleton in handling industrial oven sales in the Chicago territory. The office also will have additional lines of paint tanks, paint tank heaters and painting and agitating equipment, made by the firm.

Controls Mixtures of Gases and Liquids

Bailey Meter Co., Cleveland, recently has perfected a device for automatic regulation of mixtures of gases or liquids or a combination of the two, whereby combustion efficiency consistent with economical operation may be obtained in industrial furnaces. The apparatus especially is of value where two or more gases or liquids may be mixed to give a low cost fuel.

The accompanying illustration shows the layout of an installation for mixing two gases, one rich and the other lean. The control is operated by hydraulic pressure. Any change in rate of flow of the rich gas is reflected by a gas meter connected to that line. The recording mechanism of that meter is connected through a system of links to a pilot valve, stabilizer and another meter in the lean gas line. If the flow of the rich gas increases, the link system moves and raises the pilot valve, allowing the oil pressure to be applied to the *more* side of the power cylinder. At the same time, that latter movement opens the *less* side of the power cylinder to drain. The stabilizer tends to counteract the impulse given by the rich gas. That counteracting effect is secured by connecting the *more* oil line to the upper chamber of the stabilizer and the *less* oil line to the lower chamber of that unit. As pressure is applied to the *more* line, the *less* side is open to drain the stabilizer piston moves downward and tends to return the pilot valve to a neutral position.

That action in turn tends to equalize the pressures on either side of the stabilizer causing it also to take a neutral position. The stabilizer permits a quick-acting control which does not over-travel or hunt. Any desired ratio between two component parts of a mixture may be secured by selecting the proper ratios for the meter orifices. A further adjustment or change of ratio may be secured by use of the ratio changing device which consists of a movable pivot supporting the link system in the right hand meter casting.



Layout for Mixing Two Gases in Constant Proportions Automatically

Charger Is Powered by Gasoline Engine

Clark Tructractor Co., Battle Creek, Mich., has placed on the market a new type oven charger for loading annealing ovens. The unit has a capacity of 5 tons and is powered by a tractor type gasoline engine. Eighteen inch steel fingers are used to lift the load. Lifting is dependent on two hydraulic cylinders which are capable of lifting a load from a minimum height of 2¾ inches to an average height of 10 inches in 8 seconds. The load may be tilted back to an angle of 7 degrees. The apparatus is equipped with a counterweight at the platform end. When the load is lifted the machine can carry it at 4 miles per hour. Steering wheels are 16 x 5 inches, driving wheels, 15 x 7 inches and all wheels are rubber tired. The machine turns on a 12 foot radius. The unit also may be used for the transportation of heavy castings between the various departments of a foundry. The accompanying illustration shows an oven charger loading a malleable iron annealing oven.

The Machine Can Tip the Load To an Angle of Seven Degrees

Brazing Equipment Uses Resistance Principle

General Electric Co., Schenectady, N. Y., recently has introduced a new line of electric brazing equipment. The operation is carried on between two carbon blocks which because of their resistance to the flow of electricity generate heat. Parts to be brazed must have flat surfaces. The equipment consists of a transformer, foot switch and tongs for holding the carbon blocks and work. Capacities of the various pieces of equipment depend upon the size of the work. Typical equipment includes a 5-kilovolt-ampere transformer having a 220-volt primary and an 8-volt secondary. The 10-kilovolt-ampere transformer available for heavier work has the same primary and has 8, 10 and 12-volt taps on the secondary. Secondary taps may be changed readily for different size joints, the higher taps being used for larger sections.

The apparatus functions as follows: Work first is clamped in the tongs, flux is added and the current turned on with the foot switch. When the flux melts, the brazing alloy is held against the hot metal until the alloy flows into the joint by capillary attraction. During the process the hot alloy dissolves a thin film of the metal surfaces, thus forming a new alloy

The Work Is Heated Between Two Carbon Blocks

rich in copper with a higher melting point than the original alloy. Advantages claimed for the method are: Less time; economical operation; and conductivity, mechanical strength and durability are higher than those of a lead joint.

Ruggedness Is Feature of Clamshell Bucket

Erie Steel Construction Co., Erie, Pa., has placed on the market a new type of clamshell bucket for heavy duty service. It is a lever arm bucket, ruggedly constructed to withstand severe service. The bucket is all steel in construction and is built with sheaves at the extreme end of the power arm. Ropes have straight leads without *S* bends. The bucket may be reeved with 3, 4 or 5 parts of closing line.

The head of the bucket is provided with large bearings and built-in guide rollers. The head plate strengthens the corner bars placing the digging strain evenly on all four corners of the bucket. Scoops are well banded and the back band ties in with the power arm. Lips extend entirely to the top of the bucket and also are attached to the power arm and hinges. High carbon and manganese steel lips and special cutting edges are available as desired.

Bucket Is Built To Withstand Severe Service

Heavy flanged plates are used to make the scoops strong to withstand severe service. It is claimed that the buckets require little maintenance. Units are available in from 2 to 6 cubic yards capacity.

Transferred to Office at Cleveland

A. S. Coulter, for the past 2 years Chicago district manager, Werner G. Smith Co., Cleveland, has been transferred to the Cleveland office. Prior to his connection with the Smith company, Mr. Coulter was associated with James H. Herron Co., Cleveland consulting engineers; Westinghouse Air Brake Co., Swissvale, Pa., and Crown Cork & Seal Co., Baltimore. He is a graduate of the University of Pittsburgh, Pittsburgh, and is a member of the American Institute of Mining and Metallurgical Engineers, American Foundrymen's association and American Society for Steel Treating. Mr. Coulter will be succeeded at the Chicago office of the Werner G. Smith Co. by J. C. Gore, formerly sales manager, St. Louis Gas & Coke Corp., St. Louis.

Gets Castings Contract

Hardie-Tynes Mfg. Co., Birmingham, Ala., has been awarded the contract for one combination 5 x 10 x 4-foot sluice gate and operating mechanism for the Hill View reservoir, by the board of water supply, New York. The gate, mostly cast steel and iron, calls for 36,000 pounds of castings while 6000 pounds are needed for operating parts. A small tonnage of bronze castings is included for the structure. Bids soon will be taken for operating gates calling for several hundred tons of bronze castings.

Wisconsin Group Meets

The regular monthly meeting of the Wisconsin Gray Iron Foundry group, was held July 29, at the Tuckaway Country club, Milwaukee. The meeting was called for 2 p. m. and the afternoon was devoted to golf. Dinner and a short meeting were held in the evening followed by cards.

Malleable Iron Research institute has moved its offices from 2013 to 708 Union Trust building, Cleveland.

OBITUARY

Frank J. Oakes, 54, general superintendent, Dodge works, Link-Belt Co., Indianapolis, died at his home on July 19. He was born Oct. 10, 1875 at Decatur, Ill., and entered the service of the Link-Belt Co. in 1894. With the exception of one year, 1899, he spent his entire business career with the company as repairman and general machinist, assistant foreman in the sheet and structural iron department, foreman of the machine shop and tool room and general superintendent, a position he held until his death. He was an authority on mechanical engineering and during the war served as designer and adviser on munitions manufacture. He also was a pioneer in the development of heat treating processes and held patents for inventions in the chain industry and other fields. He was a member of the Society of Automotive Engineers, American Society for Steel Treating, American Gear Manufacturers association, and several other organizations.

Harry S. Vrooman, aged 66, died recently in Chicago. For the past 33 years he had represented various foundry supply companies but in recent years had specialized in the sale and distribution of molding sands. Mr. Vrooman was a native of Indianapolis. He entered the foundry at the age of 17 when he went to Bloomington, Ind., and became a molder. He was connected with the Bloomington Stove Co., Bloomington, Ind., for 10 years. More than 30 years ago he went to Chicago and joined the sales organization of the Garden City Sand Co.

W. McKinley Carrigues, assistant sales manager, alloy division, Republic Steel Corp., Youngstown, O., died July 15. He formerly was general sales manager, Central Alloy Steel Corp., Massillon, O., and prior to his connections with that firm had been associated with the American Steel Foundries at Franklin, Pa., and Alliance, O.

Clarence P. Brown, 40, president, Aluminum Alloy Foundry Corp., Little Falls, N. J., died July 21 at his home in Maplewood, N. J.

Expresses Appreciation

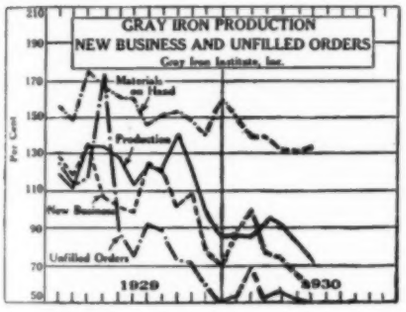
J. G. Pearce, director, British Cast Iron Research association, Birmingham, Eng., wishes to express his sincere thanks and appreciation to the foundrymen in the United States and Canada for the kindness and good fellowship shown him during his recent visit to those countries. Mr. Pearce says that his visit has given him extremely pleasant recollections and valuable experience .

Trade Trends in Tabloid

WHILE business sentiment points to an upturn, actual improvement is lacking in early August. Resumption of automobile production by a number of plants which suspended during the month of July has brought some improvement in foundry operations in Michigan, Ohio, Indiana and southern Wisconsin. A more definite advance in automotive and other lines is expected in September.

—T—T—

According to *Steel*, July marked a low point in pig iron production with a daily rate of 81,574 tons, the lowest since October, 1924, and 16 per cent below the June, 1930 rate. Only 144



of the total number, 312 blast furnaces were active during the past month.

—T—T—

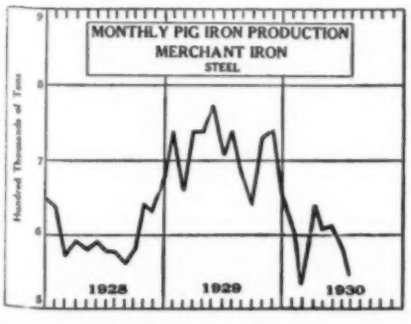
Sales of foundry iron have improved slightly, particularly in the Chicago district where a reduction in price has been an incentive. Stocks of iron are low in foundry yards.

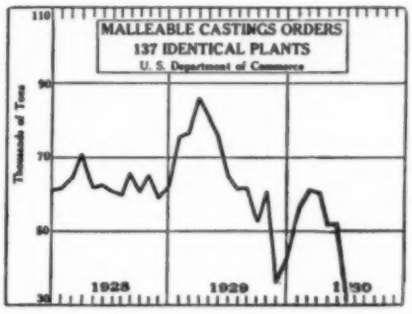
—T—T—

The most encouraging feature of the building construction situation, upon which rests a large potential casting demand, is the increase in public works and public utilities building. The total of this class of work has mounted to the highest monthly aggregate in the past five years.

—T—T—

Building supply and contracting firms expect to pickup in residence and commercial building operations. The sad experience of the small investor in stocks again has turned





attention to real estate as an investment and improved real estate as a source of earning on small capital. The tendency is aided by low material costs and cheap and abundant credit for these purposes.

—T—T—

Freight car loadings are light and car orders continue light, with small expectation of improvement early this fall.

—T—T—

The Gray Iron institute, Cleveland, reports June operations among members at 73.7 per cent of normal, compared with 81.7 per cent for May. Operations in the east are slightly in advance of those in the middle western states.

—T—T—

Farm implement outlook, although likely to be affected by drought conditions prevailing in late July, is good, according to W. C. MacFarlane, Minneapolis-Moline Power Implement Co., who reports that harvesting machinery and tractors have been sold in fair volume.

—T—T—

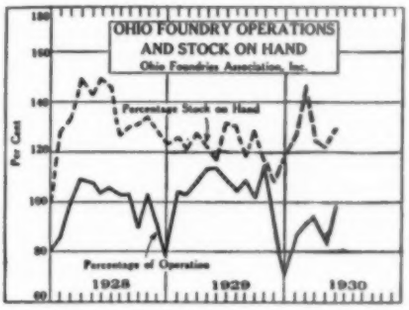
While new aluminum prices are steady, remelt has declined to 14c for No. 12 alloy.

—T—T—

Improvement is noted in plants making municipal castings such as manhole covers, gutter inlets and accessories to road and street construction.

—T—T—

Prices of heavy melting steel declined in July to new low figures, marking the fifth consecutive month



when prices of his commodity have been reduced. The present price is the lowest since July, 1928.

—T—T—

Foundries on the east coast from lower New York to Maryland are noting improvement and gray iron jobbing shops in eastern Pennsylvania are fairly busy.

—T—T—

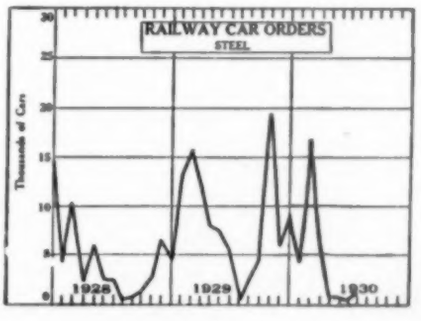
Demand for cast iron pipe is light, but valves and special fittings are in fair demand. Oil country sundries, particularly steel castings, are showing a continuance of fair inquiry.

—T—T—

Average New York prices on nonferrous metals during July, according to *Daily Metal Trade* were as follows: Casting copper, 11.170c; electrolytic copper, 11.248c; Straits tin, 29.768c; lead, 5.25c; antimony, 5.985c; aluminum, 98-99, 22.90c. Zinc averaged 4.319c, E. St. Louis, Ill.

RAW MATERIAL PRICES
Aug. 7, 1930

Iron	
No. 2 foundry, Valley	$18.00
No. 2 Southern, Birmingh.	14.00
No. 2 foundry, Chicago	17.50 to 18.00
No. 2 foundry, Buffalo	18.50
Basic, valley	18.00
Basic, Buffalo	18.00
Malleable, Chicago	17.50 to 18.00
Malleable, Buffalo	19.00
Coke	
Connellsville Beehive coke	$3.50 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$15.00 to 15.50
Heavy melting steel, Pitts.	14.50 to 15.00
Heavy melting steel, Chi.	12.00 to 12.25
Stove plate, Buffalo	10 25 to 10.50
Stove plate, Chicago	9.50 to 10.00
No. 1 cast, New York	9.50 to 9.75
No. 1 cast, Chicago	12.00 to 12.50
No. 1 cast, Philadelphia	13.50
No. 1 cast, Pittsburgh	14.00 to 14.50
No. 1 cast, Birmingham	12.00 to 13.00
Car wheels, iron, Pittsburgh	15.00 to 15.50
Car wheels, iron, Chicago	13.50 to 14 00
Railroad malleable, Chi.	13.50 to 14.00
Agricultural mal., Chicago	12.25 to 12.75
Malleable, Buffalo	15.00 to 15.50
Nonferrous Metals	
	Cents per pound
Casting, copper, refinery	10.87½
Electro, copper, producers	10.87½
Straits, tin	30.10 to 30.12½
Lead, New York	5.50
Antimony, New York	8.00
Nickel, electro	35.00
Alumi'm, No. 12, producers	22.00
Aluminum, No. 12, remelt	14.00 to 14 50
Zinc, East St. Louis, Ill.	4.45 to 4.50



What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Plant of Gagne Brass & Aluminum Foundry, 56 Jefferson avenue, Salem, Mass., recently was damaged by fire.

Lincoln Foundry, Mt. Carmel, Ill., recently suffered a $1,000 fire damage to its patterns.

Belle City Malleable Iron Co., 1442 Forest street, Racine, Wis., has let contract to Nelson & Co. for a 1-story shop addition, 40 x 80 feet.

Pattern shop of the Springfield Foundry Co., 3213 Smallman street, Pittsburgh, recently was damaged by fire. Loss is estimated at $20,000.

General Brass Foundry Co. Inc., Newark, N. J., has been incorporated with $125,000 capital by Manuel Hoenig, 9 Clinton street, Newark.

Foundry of C. M. Thompson's Sons, Lexington, N. C., recently was damaged by fire. The loss is estimated at approximately $50,000.

Liberty Foundry, 7600 Vulcan avenue, St. Louis, recently was damaged by fire. The loss is estimated at $5000. Damage to elevators to the charging floor will be repaired by the company's maintenance department. No building material or additional equipment will be required.

Metal Mold Casting Corp., Wilmington, Del., has been incorporated with $1,000,000 capital by Delaware Charter Co., to deal in metals, alloys and tools.

Reliance Foundry Co., 506 East Front street, Cincinnati, has a building permit for repairs and alterations to its shop. Estimated cost is $450.

American Brake Shoe & Foundry Co. of California has moved its offices from 1178 East Thirty-second street to 5309 East Slauson avenue, Los Angeles.

Pottstown-Stotter Tank Works Inc., Pottstown, Pa., has been incorporated with $100,000 capital to manufacture and deal in tanks, pipes, castings, oil and chemical equipment.

Haynes Stellite Co., Kokomo, Ind., has awarded a contract to C. L. Sanders & Son, Portland, Ind., for a plant on Park avenue. The cost is estimated at approximately $50,000.

Dallas Machine & Locomotive Works, Dallas, Tex., is reported to be considering the erection of a steel foundry at Klamath Falls, Oreg.

The foundry and several other departments of the plant of B. S. Freeland Tank Co., Sturgis, Mich., recently were damaged by fire. The loss is estimated at $2,500.

Reed Prentice Corp., Worcester, Mass., has resumed with normal forces, both in machine shop and foundry after a two-weeks shutdown to enable all its men to take a simultaneous vacation.

Pittsburgh Valve & Foundry Co., Pittsburgh, has expanded its employe's group insurance plan to include the benefits of health and non-occupational accident protection. The cost of the additional protection is shared by employer and employes.

Benton Harbor Castings Co., Benton Harbor, Mich., recently suffered slight fire damage to its plant. Loss is estimated at $600. Company is a division of Benton Harbor Malleable Industries Inc.

San Antonio Machine & Supply Co., San Antonio, Tex., has bought the foundry department of the Central Texas Iron Works, Waco, Tex., and will consolidate it with its plant in Waco.

Reliance Steel Castings Co., Twenty-eighth and Smallman streets, Pittsburgh, has awarded a contract to McClintic-Marshall Co., Oliver building, for a 2-story, 50 x 60-foot addition. (Noted June 15.)

Jacob Libovitz is establishing a foundry at Napoleon, O., to specialize in inlets, rings and manhole covers.

Specialty Brass Co., Kenosha, Wis., is reported to be considering plant enlargement.

A. C. Williams Co., Ravenna, O., will build an addition to its foundry which will increase the plant capacity about 35 per cent. A contract has been awarded to P. L. Frank Construction Co.

Vulcan Iron Works, John street, New Britain, Conn., branch of Eastern Malleable Iron Co., Naugatuck, Conn., has plans for the construction of a 1-story plant, 70 x 175 feet. Cost is estimated at $50,000. M. J. Unkelbach, 52 Main street, is architect.

Republic Brass Co., 1623 East Forty-fifth street, Cleveland, has awarded a contract for a one and two story, 21 x 136-foot, foundry addition on East Forty-seventh street to A. A. Lane Construction Co., 1873 East Fifth-fifth street. Christian, Schwarzenberg & Gaede Co., Union building, is the architect.

Gray Iron Foundry Co., and the Mount Penn Stove Co., both of Reading, Pa., are starting operations after being shut down for some time. The Reading Brass Works and Dick Brothers, Inc., also of Reading, report business good.

Superior Pattern Works, Anderson, Ind., has moved from its location at Fourteenth and Main streets and now is occupying a building at Midland railroad and Jackson street. The company will double its production space and has installed an electric aluminum melting furnace. Production in the aluminum foundry began July 21.

New Trade Publications

CRANES AND DERRICKS—Bedford Foundry & Machine Co. Inc., Bedford, Ind., in a bulletin shows illustrations of various types of its cranes and derricks.

SPEED REDUCERS—Philadelphia Gear Works ,1129 Vine street, Philadelphia, has issued a catalog of its speed reducing units, 120 pages, illustrated.

IMMERSION PYROMETER—Illinois Testing Laboratories Inc., 141 cribes in a current bulletin its pyrometer for accurate determination of the temperature of metals to be cast.

MATERIALS HANDLING—Link-Belt Co., Chicago, has issued a pamphlet covering the history of the company since its founding in 1880. Illustrations of typical uses of its materials handling and power transmission equipment are included.

TRAMRAILS—Cleveland Electric Tramrail, division of Cleveland Crane & Engineering Co., Wickliffe, O., has printed a folder containing illustrations of the equipment made by the company.

CASTINGS CHART—William J. Sweet Foundry Co., division of the Industrial Alloy Products Co., 8 Lister avenue, Newark, N. J., has prepared a revised chart of its range of chrome iron and chrome nickel iron alloys for corrosion and heat resistance, giving late information on applications of each. The chart also explains results from a new method of castings practice to obtain stainless steel castings suitable for polished surfaces.

INGOT MOLDS—Vulcan Mold & Iron Co., Latrobe, Pa., manufacturer of ingot molds of special iron, is distributing a map showing the location of its plant with relation to manufacturing centers to which its product is shipped. Facilities for direct shipment are indicated.

SYNCHRONOUS MOTORS—General Electric Co., Schenectady, N. Y., recently issued a pamphlet describing its series of general-purpose synchronous motors; descriptive data and applications are covered.

CENTRIFUGAL PUMPS—Pennsylvania Pump & Compressor Co., Easton, Pa., is distributing a bulletin on its double suction, single stroke centrifugal pumps, with ample illustrations and full description of construction and operation.

ACID RESISTING TANKS—The American Hard Rubber Co., New York, recently has published a 54-page catalog describing its rubber-lined tanks and other equipment for handling acids. The tanks described may be used as containers for acid pickles or plating solutions.